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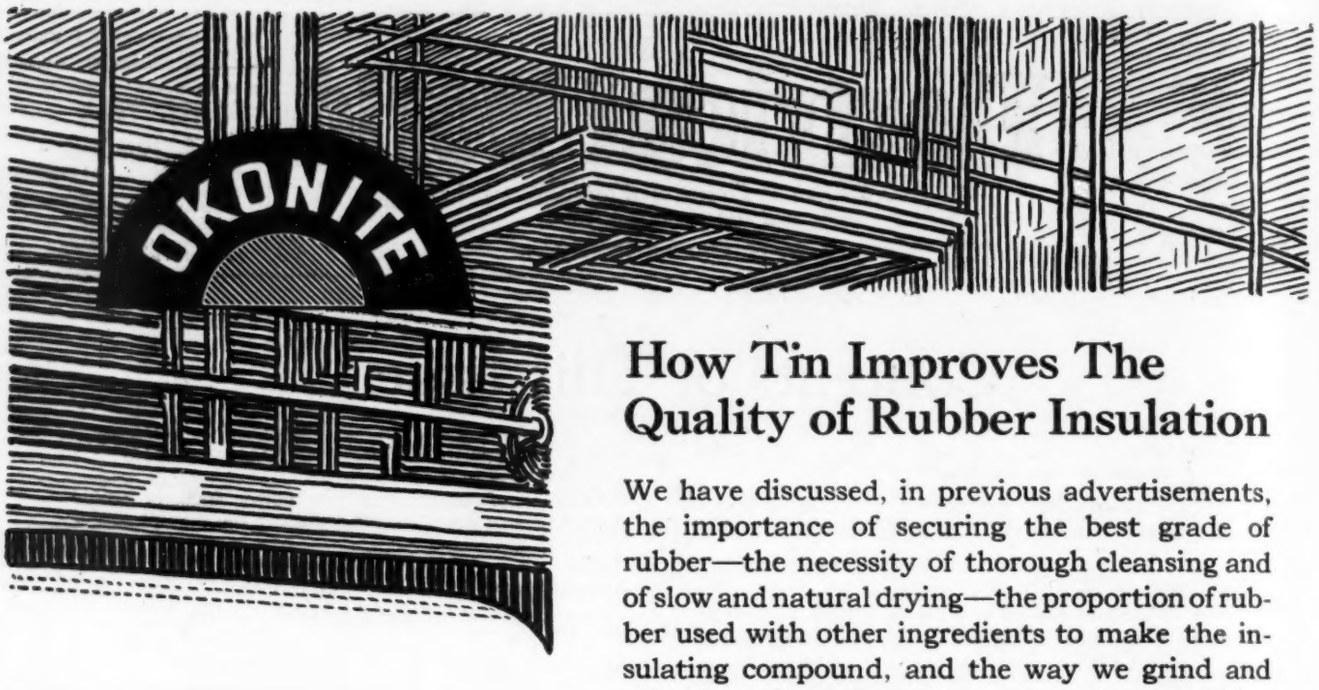

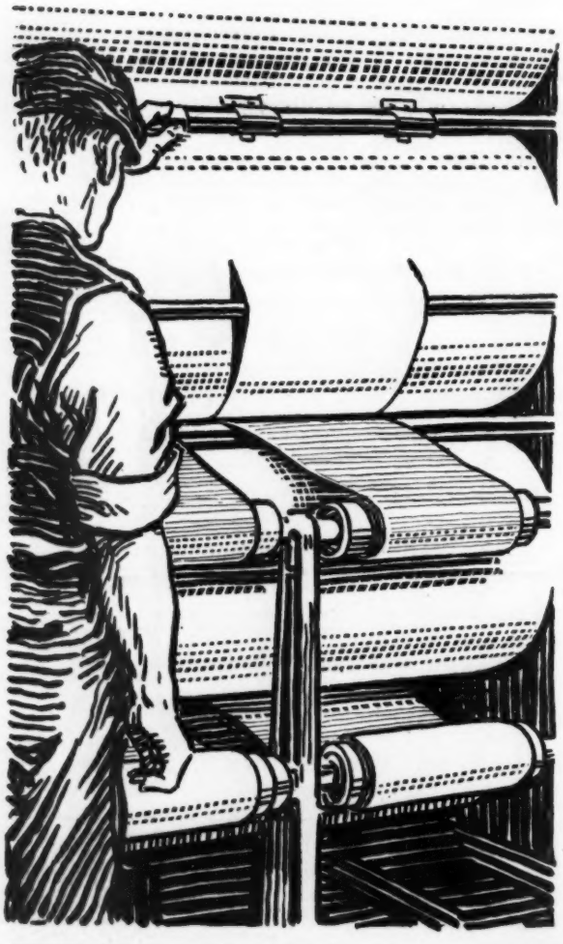

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We have discussed, in previous advertisements, the importance of securing the best grade of rubber—the necessity of thorough cleansing and of slow and natural drying—the proportion of rubber used with other ingredients to make the insulating compound, and the way we grind and mix these ingredients to assure the durability and toughness of the finished product. Now comes a simple yet a vitally important process. We warm the "rested" compound and run it through a calender which forms it into sheets of the required thickness for each insulating wall. These sheets, in turn, are backed with sheets of *tin* which are *essential* to the exclusive Okonite method of applying insulation to the conductor and in the final process of vulcanization. Our following advertisements will describe these final processes, showing how each step in manufacture contributes to the unduplicated quality of all Insulated Wires and Cables made under the Okonite brand.

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Electrical World

McGraw-Hill Publishing Company, Inc.
JAMES H. MCGRAW, *President*

W. H. ONKEN, JR.
Editor

VOLUME 91 — *New York, Saturday, May 5, 1928* — NUMBER 18

Boulder Dam and the Congressional Situation

DEBATE on the Boulder Canyon bill has been in full swing in the Senate, but the measure will soon have to make way for the tax bill and possibly for action on the expected veto of the flood-control bill. As a matter of fact its proponents fear its defeat and are prepared to compromise on a low dam at Boulder Canyon with a foundation capable of sustaining ultimately a structure of the height sought in the present Swing-Johnson bill. However, in view of the opposition to the measure and to the absence of any treaty between the states in the Colorado River basin apportioning the water, it is problematical whether any action will be taken at this session of Congress.

Fortunately, time has sufficed to shed light on many of the questionable features of the proposed measure, on the engineering aspects of the project, on the selfishness of California—and especially Los Angeles—and on the rights of the other states. The fact has also been accentuated that every one wishes to protect the Imperial Valley, although the menace is not so great as the California senators would have people believe. Besides, since Dwight Morrow has been Ambassador to Mexico there is a general change of sentiment toward the Southern republic and the administration is not now seeking clubs like the Boulder Canyon Dam to hold over Mexico's head. Best of all, however, is the growing resentment against the government engaging in business under any pretext, and it is that sentiment—one the politicians are beginning to discern—which will play an important part in keeping Congress within bounds.

* * * *

Worcester Rate Adjustment a Sensible Step

PENDING final determination in the federal court of the Worcester case against the Massachusetts Department of Public Utilities, the contestants have agreed on a six-cent rate. The injunction against the commission was modified in the District Court at Boston to permit the new rate to become effective, and domestic users of electricity in Worcester will receive the benefit of the reduced rate at once. Both the commission and the utility company are to be commended on such a sensible arrangement.

From the viewpoint of regulation a 15 per cent reduction in the Worcester rate is a victory for the Massachusetts Department of Public Utilities. To be sure, 15 per cent is not so drastic a cut as 30 per cent; but a bird in the hand is worth two in the bush. The Worcester Electric Light Company would undoubtedly suffer a loss in income were the 30 per cent reduction to be applied at once. As it is, the courts may sustain the commission, in which case the full reduction will become effective; but the litigation might consume years. Meanwhile a voluntary cut of 15 per cent is granted, and by the time the case is settled—presuming that the decision goes against the utility, which is not at all certain — the company will have adjusted itself to the change. Regardless of the final outcome, however, the present reduction will stand, and if after a reasonable trial it is shown to be highly remunerative, we feel certain that the Worcester Electric Light Company will voluntarily grant to the Massachusetts commission what the latter may not be able to wrest from it by law. Such, certainly, would be a reasonable and sensible disposition of the case and one in entire harmony with the best public policy.

* * * *

Is the Federal Trade Commission Getting Anywhere?

WHEN the public utility companies of the country were by action of the United States Senate ordered to be investigated by the Federal Trade Commission, the supposition was that the Federal Trade Commission, following its usual custom, would make a thorough investigation and report its findings in due season. That, subsequent developments have shown, was a delusion. The *ex parte* hearings being conducted in Washington are a joy to the tabloid and radical press, whose staffs crowd the hearing room and mull over every exhibit and piece of evidence, seeking sensation and scandal. Moreover, either by coincidence or by careful planning, some of the testimony sought relates to Boulder Canyon, which is now being debated in the Senate. If the proponents of that measure can get any help from the testimony before the Federal Trade Commission, they are welcome to it, for apparently they will need all the help they can muster and even then not succeed in getting their measure passed.

Touching the basic functions of the electric light and power industry—that is, the technique and economy of its service—there is not a word in the record, nor apparently, for obvious reasons, will much be sought. Along these lines the industry is well-nigh invulnerable, and it is because of that that municipal plants are losing ground and that the United States excels electrically. From a public relations angle the industry has much to learn, and it is fortunate for it that the product itself so far excels the sales argument made for it. Were this not so, the critics and defamers of the industry might be able to show some progress; but the economic performance of the industry is a rock against which they have learned from bitter experience that it is useless to dash their heads. For that reason they concentrate on and magnify propaganda, little realizing that a pound of fact will

outweigh a ton of propaganda and that it is the facts of the electric light and power industry, and not the propaganda, that have made it so successful. We had hoped the Federal Trade Commission would bring these points out, and it may be that eventually it will. So far, however, it has merely reported some spicy gossip and old women's tales.

* * * *

Flexibility in Standardization

THE American Engineering Standards Committee has changed its procedure in order to speed up standardization work. A sectional committee may now be autonomous; a proprietary standard is recognized and also the right of the proprietary organization to revise this standard, and a third change permits of making a standard by the action of a general conference of interested parties. Flexibility is provided in standards making, so that a quick procedure can be followed for any standard at issue.

Comments on the new procedure will be pro and con. Some of the member societies may object to the non-use of the sponsor in all cases of standards making, and there may be disputes as to jurisdiction or the method of making a standard. But only selfish interest can wreck the new plan. It is a great step in advance toward the national standardization plan advocated by the ELECTRICAL WORLD. It deserves the support of the electrical industry and a thorough trial.

* * * *

The Key to the Great Power and Industrial Heating Load

IT IS interesting and fortunate that the development of the further markets for electric power and electric heat in the industrial field both call for the same general approach on the part of the sales departments of the power companies. In each case the major consideration is the analysis of the diverse production problems of the many types of manufacturers to whom these applications of electric service offer opportunities to reduce costs, increase output or improve the quality of the product. Two kinds of service are offered, but for both the first step is to study the production processes of industry.

The further building of both power and industrial heating load is essentially a selling job, and it requires the same kind of man power. It calls for technically trained salesmen who can go into factories and be helpful, because they understand the mental attitude of the factory man and can sense his troubles, talk his language and win his confidence and co-operation. For electric motors and electric furnaces are not purchased save as they give promise—nay, conviction—of resulting economies through improved control, saving of space, elimination of labor, faster speed, reduction of waste or some other desired advantage. The first prime qualification of the power company's engineer, therefore, is his ability to think as a practical factory man.

The basic resource for such work is experience data—information on the conditions surrounding the various types of factories, their peculiar problems and case records that prove the value of electric power or heat. The power companies need a generous fund of such guidance well organized for study and for use. With it the utility man himself may have a practical competence in specifying the smaller sizes of motors and the simpler forms of heat equipment. But for the more intricate installations he must have recourse to experienced utility engineer salesmen and to the manufacturer's specialized application engineers. A poorly sold job is a boomerang where further business is concerned.

It is roughly estimated that but half the power used by industry is now purchased from central-station systems and that the industrial heating load will some day exceed the motor load in size. It is worth working for—and now. But, first of all, it must be made a matter of policy with every company to provide and sustain the man power to develop this waiting business. Here is the key to this great market.

* * * *

Scholarship Brings Dividends

BUSINESS success in the telephone industry depends largely on scholarship. Walter S. Gifford, president of the American Telephone & Telegraph Company, so declares in a recent article in *Harper's Magazine*. Records of 4,125 graduates from 104 colleges were studied carefully and showed that 498 men who had been graduated in the first tenth of their respective classes began to forge ahead of their fellow graduates after about five years of employment by the Bell system. The advantage continued to exist and after twenty-five years of employment these men advanced very rapidly. According to these records, men from the first tenth in college have four times the chances of those from the lowest third to stand in the highest-tenth salary group.

The trend toward the operation of business establishments by hired managers places a premium upon mentality and knowledge. The robust athlete with his 'varsity letter must add to it a Sigma Xi or a Phi Beta Kappa key if he expects to be a leader of his business associates.

* * * *

New Light on Conduction

ELECTRICITY is thought to be granular in structure, and electric conduction is said to be either electronic or ionic in solids, liquids and gases. Electronic conduction occurs in copper wire, for example, and is not associated with the transfer of matter, but in ionic conduction electricity is associated intimately with the transfer of matter. There is no order in the matter, for both types of conduction occur in liquids, solids and gases. Nor does either theory of conduction afford us a conception of what electricity is as a physical entity.

We have become accustomed to using these theories to develop laws which engineers use in practical calculations. One of these laws, intimately related to the theory of electronic conduction, states that resistance will become infinite in conductors when the temperature of the material drops to absolute zero. Recent experiments with liquefied helium by Kammerlingh-Onnes give data which prove the exact opposite. The conductivity of certain metals becomes infinite instead of zero at absolute zero. Instead of resistance increasing as the temperature decreases, the opposite effect occurs, and in certain metals a sudden and very rapid decrease in resistance occurs at a definite temperature. Mercury, tin, lead, thallium and their alloys show this phenomenon and have virtually zero resistance at absolute zero. Why this phenomenon occurs nobody knows, nor does it seem to have any practical importance to engineers. But no one

can predict the future, and this phenomenon, recent research work on the effect of purity on conductivity, other recent researches which seem to indicate that magnetism is caused by electronic currents—all these have an interrelation which will be found by some research worker.

Practical applications always follow hard on new knowledge, and the recent researches at least permit engineers to discard another so-called law in electrical engineering. Fortunately Ohm's law seems able to stand the scrutiny of modern experimenters.

* * * *

Capitalization and Regulation

A SECOND refusal by the Public Service Commission of Maryland to approve the purchase of four small light and power properties in that state by a Chicago holding company has followed a rehearing necessitated by a court decision that disapproval could not be based merely on the commission's opinion that no benefit to the public was involved in the sought-for transfer. A utility sale, the court pointed out, does not have to be shown to be of positive benefit to the public; it is enough that it be not detrimental to it. It may easily be that the public has nothing to gain by the sale of Company A to Company B. But if the public loses nothing, its interest is not affected and the commission should not interfere in what then has the character of a private negotiation.

Accepting this dictum as in duty bound, the Maryland commission again dismissed the petition, this time stigmatizing the proposed sale as "detrimental" to the public interest and thus substituting a positive for a negative reason to explain its action. Its real ground of objection was that the sum to be paid was far in excess of the reproduction cost arrived at by the commission engineers. It thus refused to indorse the principle that since such capital expenditures do not influence the rate base they can be approved, even when extravagant, without injury to customers. In view of the inflated prices often paid by expanding companies for competing, obstructive or "logically belonging" plants—sometimes to the enrichment of municipalities, which thus occasionally vindicate as a temporary expedient the policy of public ownership in a way the original proponents little meant—it will be interesting to see whether the Maryland commission's stand will be maintained and whether it will be followed by other commissions.

* * * *

Making Research Developments Available to Industry

REDUCING the time lag between the discoveries of pure scientific research and their application in industry is directly dependent not only on the growth of fundamental research resources, but also on adequate industrial research laboratories to apply the discoveries. The smaller the time lag, the more prosperous the industry and the nation. Pure scientific research has developed theories which at the time of discovery have appeared to be little more than interesting curiosities. At a later date industrial research laboratories, using these theories as a basis, have developed a means of applying them to industry so that finally they become an every-day necessity. In this way our national wealth is increased.

When Michael Faraday in 1831 discovered the principle of electromagnetic induction, he had no definite idea concerning any use to which it could be put, although he expressed his confidence in its ultimate practical application. When asked by the Prime Minister of his country as to its use, he replied: "My Lord, some day you may tax it." Events have proved to a degree undreamed of even by Faraday how true his words were. The discovery some months ago that a single copper crystal of large size had a conductivity 13 per cent greater than ordinary copper wire with its numerous crystals arranged in all directions may some day be put to work through the medium of our industrial research laboratories.

It is significant that the industries which have the best established industrial research laboratories are built on fundamental scientific research. The industrial research laboratory has played a major part in the development of the electrical industry. High-pressure and large-capacity steam generating units have been made possible only by continued research work. As one manufacturer expressed it: "Research has sold itself on the basis of dividends on every dollar spent in studying problems, and the return has more than justified it." Further development of our resources for industrial research is fraught with possibilities beyond our ken.

* * * *

Chemical Applications of Electricity

RESEARCH workers persist in their efforts to generate electricity by chemical action, but only primary and storage cells of relatively low capacity have resulted from their efforts. Nothing yet discovered gives promise of energy production on a commercial scale by the use of chemical reactions. At the Bridgeport meeting of the American Electrochemical Society this topic was discussed at length. Papers outlined many improvements in primary and storage batteries, but the ingredients used fifty years ago still persist in the modern devices. Greater purity in materials, better manufacture and slight improvements obtained by adding small amounts of other material make the modern cells better than those of the days of Le Clanché, but no one has been able to find basic constituents superior to those discovered in the early days.

Great advances, however, have been made in the applications of electricity to chemistry and metallurgy. Electrochemical, electrothermic and catalytic effects have been introduced to improve processes and to make new products. Chromium plating is a new and very valuable application; hydrochloric and nitric acids are produced by direct distillation, using the acid itself as a resistor heater; the induction furnace for melting brass and silver has been welcomed; the arc and resistor furnaces have improved processes and products in ferrous and non-ferrous melting and treating.

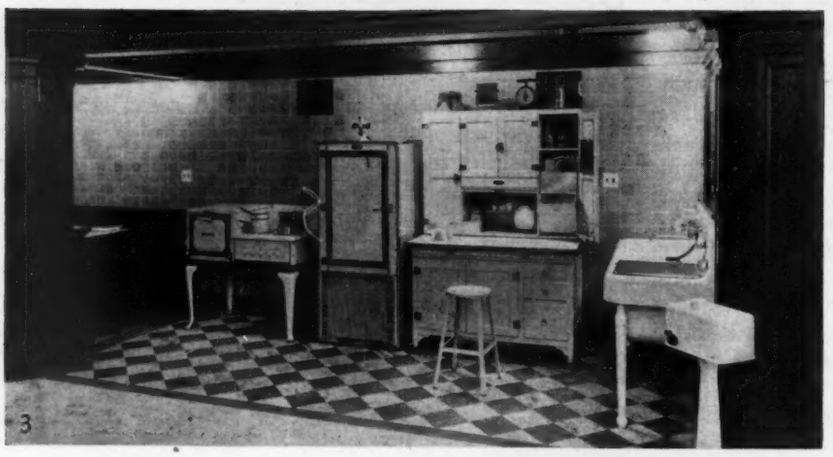
It is in these directions that the greatest advances are now being made. These applications have resulted in marked economies, improved products and new products, and yet only the surface of possibilities has been scratched. Engineers would do well to keep abreast of the notable developments brought about by the electrochemists and electrometallurgists. They are makers of new industries, and their tools are electric.

Public Relations Aided by Design of Utility Office Building

Electric shop, with lamp department, cashiers' counter and sales department at rear

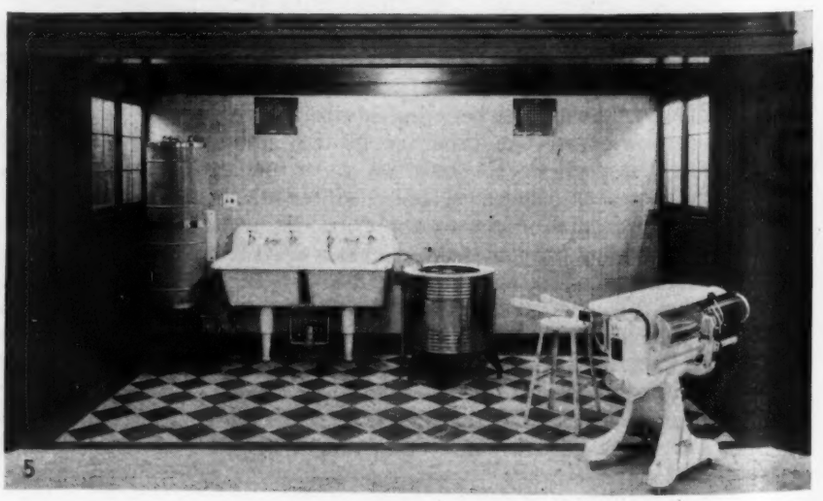
"Meet Me" corner, for customers' convenience near entrance of electric shop

Model kitchen and breakfast nook in street floor alcove

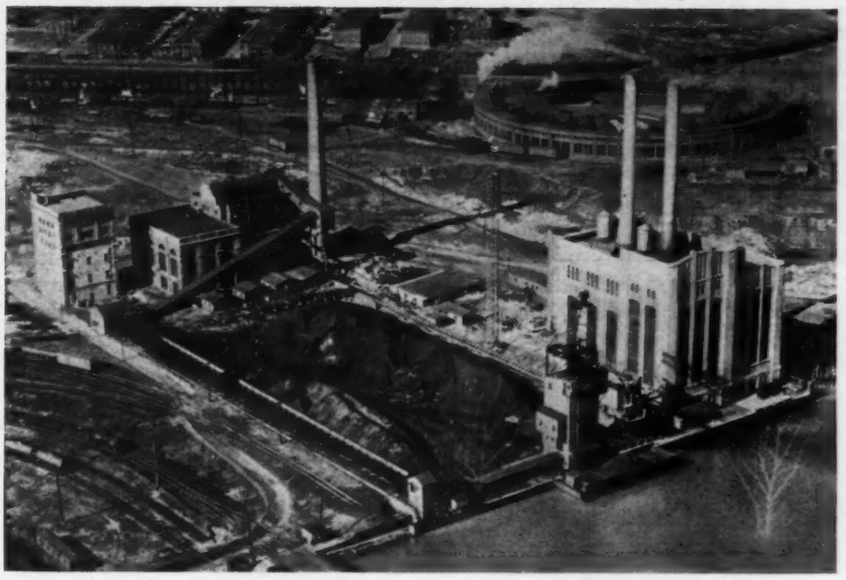


Night view of company's new home

Model laundry with electrically heated boiler and illuminated window effects to reproduce outdoor scenery



ONE OF the most beautifully appointed utility office buildings in the Northeast was thrown open to the public recently by the Public Service Company of New Hampshire, at Manchester. With a finely equipped street and mezzanine-floor electric shop, a heavy-duty appliance department in the basement, executive offices and auditorium on the upper floors, the new headquarters combines hospitality to customers with modern display methods.



Baltimore's New Station*

One boiler used per turbine. Low voltage auxiliaries. Automatic equipment employed. Descriptive features at Gould Street plant

THE new Gould Street plant of the Consolidated Gas, Electric Light & Power Company, which began operation in January, 1927, is located in the city of Baltimore on the Patapsco River, an arm of the Chesapeake Bay. The new station has one 36,000-kw. unit operating and a second duplicate unit which will begin operation next month. The plant is designed for four 36,000-kw. units, a total of 144,000 kw. at 60 cycles. The energy is distributed by underground cable at 13,200 volts without transformation. The plot measures 405 ft. x 635 ft. and is of sufficient size to supply load growth for perhaps ten years.

Coal-Handling Facilities

Coal is unloaded from barges by an electrically operated tower with Mead Morrison equipment and a 2-ton bucket, the present tower having an all-day capacity of 165 tons per hour. The future twin tower will increase the capacity to 300 tons per hour. The coal from the tower hopper passes through a Bradford breaker and thence by belt conveyor to yard storage or coal preparation building.

All of the conveyors are equipped with 36-in. rubber belts and have a capacity of 336 tons per hour. There is no speed adjustment on any of the belts; the ribbon principle is used, the rate of feed or thickness of ribbon of coal is regulated by the apron feeder which delivers coal to the Bradford breaker. At the present time coal is being stocked out and reclaimed by a gasoline-engine-driven, crawler crane, equipped with a 1-yd. grab bucket. The capacity of this rig is about 60 tons per hour. When the third generating unit is installed it will be necessary to purchase a traveling bridge.

The machinery in the coal preparation house for preparing and transporting the coal comprises two 20-ton Raymond roller mills, each with a separate exhauster and circulating system and steam air heater; two transport pumps, each having a nominal rate of capacity of 40 tons per hour, and two 735-cu.ft. motor-driven air compressors. The original installation included steam driers, but these have been replaced by the system of drying in the mill. Air from a tubular air heater using steam at boiler pressure is blown into the circulating air as it enters the mill, providing hot, dry air to absorb moisture from the coal in the mill. Sufficient air is bled off from the top of the cyclone to discharge the moisture picked up and keep the humidity of the air in the circulating system below the dew point. This air bled off is replaced by heated air coming from the air heater, which is mixed with the recirculating air before it enters the mill. The cyclones in which the air and coal are separated discharge the coal into the hoppers above the coal transport pumps. The air drawn off from the circulating system passes through a concentrator, in which the heavier solids are removed, and from there it passes through a washer.

All of the equipment in the preparation plant is electrically driven, using 440-volt, three-phase, 60-cycle, squirrel-cage type motors. There are no circuit-interrupting devices in the preparation plant. Motors are controlled from watertight push buttons operating contactors located in a control room. Sequence interlocks are provided on the controls to prevent flooding or jamming of the coal-feeding system.

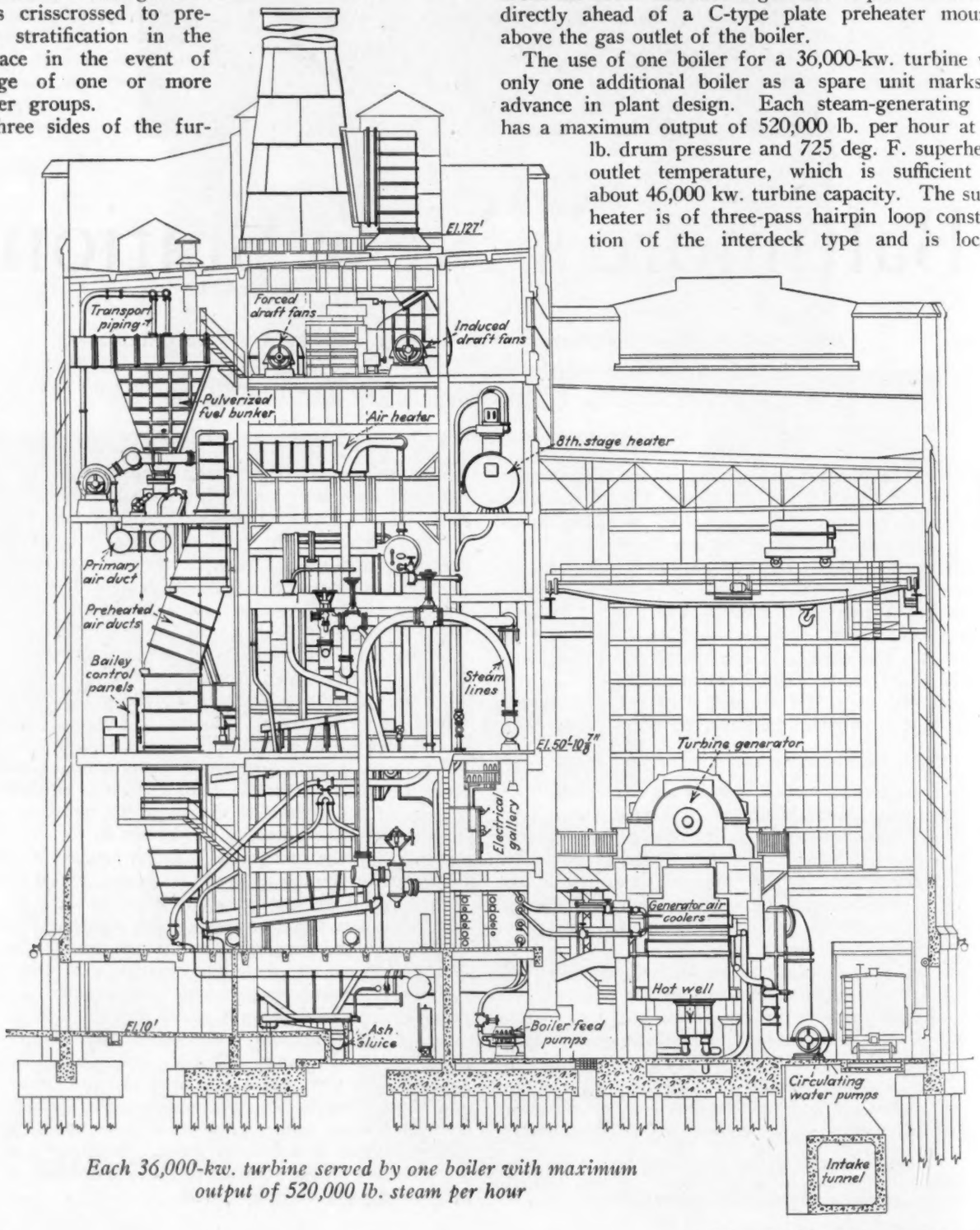
**Abstract of paper by A. S. Loizeaux, electrical engineer of the Consolidated Gas, Electric Light & Power Company, presented at regional meeting of the A.I.E.E., April 18, 1928.*

Coal is pulverized in the mills so that 70 per cent will pass through a 200-mesh screen. After collection in the cyclones, pulverized coal enters the transport pumps and in combination with compressed air is transported through 6-in. pipe lines about 75 ft. long to the bunkers in the power house. The transport pumps and pipe lines are in duplicate and are so arranged that either pump can handle the output of either or both mills. The two boiler bunkers may be fed by either of the transport lines, selection being obtained by electrically operated transport valves located over the bunkers. The powdered fuel bunkers are insulated to prevent condensation inside the bunker. The coal is fed by four quadruplex screw feeders per boiler to sixteen Lopulco type burners through 6-in. pipes crisscrossed to prevent stratification in the furnace in the event of outage of one or more feeder groups.

Three sides of the furnace are water-cooled by fin-tube surface backed by special tile, rock-wool insulation and steel casing. The front wall is of firebrick, cooled by the preheated secondary air, admitted to the furnace through ports at sixteen levels in this wall. A water screen interconnected with the rear wall circulating system protects the ash hopper.

Primary air, used to convey powdered fuel from the screw feeders to the burners, is a mixture of preheated air tapped from the secondary duct and tempered room air. Primary air is supplied by two fans per boiler, connected on the discharge by an air bus, which makes any fan available for either boiler. Two forced-draft fans per boiler furnish the secondary air taken from the room and discharged into a plenum chamber directly ahead of a C-type plate preheater mounted above the gas outlet of the boiler.

The use of one boiler for a 36,000-kw. turbine with only one additional boiler as a spare unit marks an advance in plant design. Each steam-generating unit has a maximum output of 520,000 lb. per hour at 450 lb. drum pressure and 725 deg. F. superheater outlet temperature, which is sufficient for about 46,000 kw. turbine capacity. The superheater is of three-pass hairpin loop construction of the interdeck type and is located



Each 36,000-kw. turbine served by one boiler with maximum output of 520,000 lb. steam per hour

between the fifth and sixth rows of boiler tubes, as shown in the illustration at the right.

Hydraulically operated ash gates are provided on the bottom of each end ash hopper which allow the ash to drop on inclined feed plates, from which it is washed into the main sluice by jets of water.

The alternator is a 43,750-kva., 13,200-volt, 62½-cycle machine, which is designed to operate later at 60 cycles. In addition to the main generator there is a shunt-wound shaft exciter, rated at 250 kw., 250 volts direct-current overhung on the main shaft, and beyond this and connected by means of a Fast flexible coupling is an auxiliary generator having a capacity of 1,500 kva.

The turbine is a thirteen-stage Rateau impulse machine of 36,000 kw. capacity and drives the main generator through a Fast flexible coupling. It is a modified form of a turbine of lower normal rating of the non-bleeding type. The initial stages, however, have been opened up to pass the additional steam used in bleeding. Steam is supplied at a normal pressure of 390 lb. and a total temperature of 700 deg. F. Steam is bled at the third, fifth, eighth and tenth stages at full-load pressures of 193, 99, 30 and 9 lb. absolute respectively. The turbine is designed for highest efficiency at 25,000 kw. load, and when bleeding steam at four points the unit can produce a net station send-out of 36,000 kw. A larger output can be produced by bleeding at the two lower points only.

A 30,000-sq.ft., two-pass condenser is bolted directly to the bottom of the turbine exhaust casing and is supported partly by the casing and partly by springs on structural piers on the basement floor. The circulating water passages are so arranged that the cooler water leaving the air devaporizing and cooling section is returned in the second pass in the annular ring of tubes around the outside of the top section with which the exhaust steam first comes in contact. The shell is eccentric with the tube sheet, providing a steam belt which on one end extends to the hot well, and prevents excessive condensate depression. The tubes are rolled into both tube sheets.

Generator Cooling

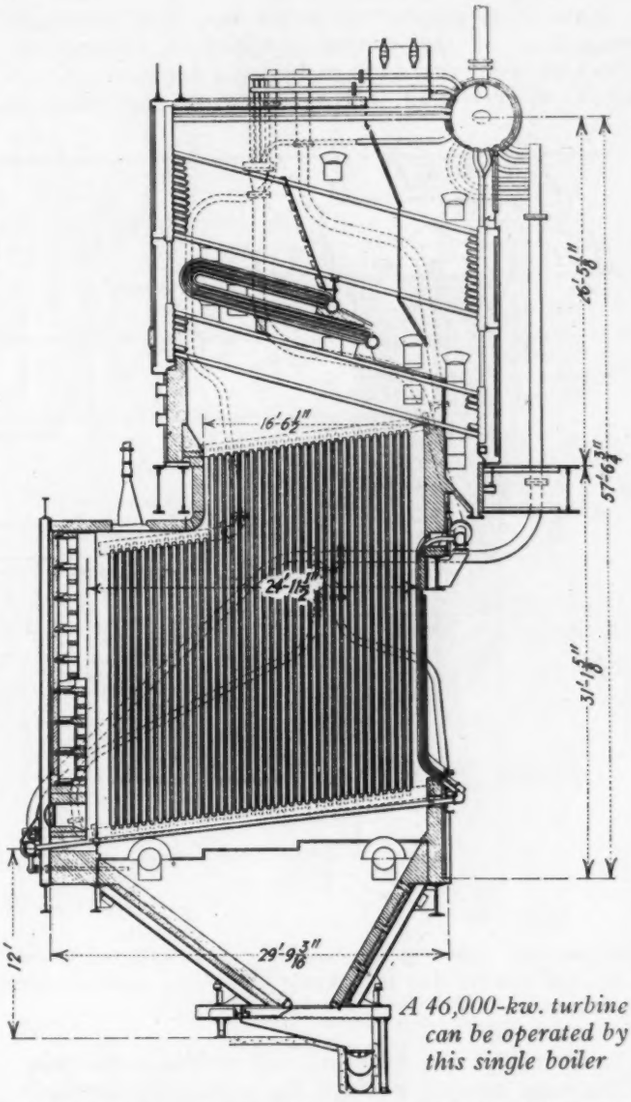
Both the main and auxiliary generators have closed recirculating air cooling systems with two banks of coolers in each, one bank using condensate and one harbor water. The harbor water coolers are connected in parallel with the condenser circulating water system. Condensate cooling is sufficient except for the summer months. The harbor water bank alone will provide sufficient cooling for maximum requirements.

Air is removed from a devaporizing section at the bottom of the condenser by a steam-jet air pump provided with a two-pass intercondenser, cooled by condensate only. Vent steam from the two top stage bleeder heaters and from the vent condenser of the deaërating heater is also condensed in the intercondenser. The exhaust from the second stage jet is condensed in the after condenser.

Circulating water from the Patapsco River passes through bar iron trash racks and traveling water screens into an intake tunnel which will extend the length of the turbine room. Each condenser is supplied by two motor-driven pumps of 20,000 gal. per minute capacity each, both of which are required under full-load conditions in the summer. A steam-jet ejector is used for priming the circulating water pumps.

The third-, fifth- and tenth-stage bleeder heaters, the evaporator condenser and the after condenser are of the vertical closed type with four passes each. The construction of these heaters is shown in an accompanying illustration.

The eighth-stage heater is of the direct-contact deaërating type in which part of the bled steam is used in a section into which the condensate is sprayed through jets and part is used in another section similar to the open type feed heater in which trays are located and from



A 46,000-kw. turbine can be operated by this single boiler

It has sixteen powdered coal burners, fin-tube cooled side walls and furnace measuring about 25 ft. deep by 31 ft. high.

IMPORTANT RATIOS FOR GOULD STREET STATION

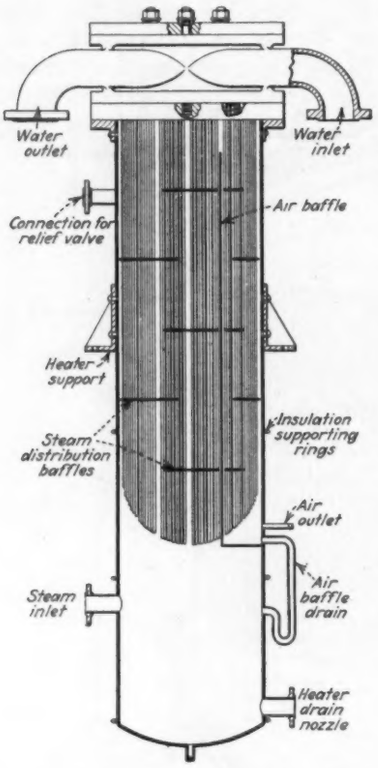
	Present	Ultimate
Condenser surface per installed kilowatt, square feet	0.833	0.833
Circulating water per installed kilowatt, gallons per minute	1.25	1.25
Kilowatt installed capacity per boiler	18,000	28,800
Boiler heating surface per installed kilowatt (including water screens)	1.617	1.009
Furnace volume per installed kilowatt, cubic feet	1.167	0.729
Furnace volume per rated boiler horsepower, cubic feet	7.22	7.22

Square feet of area and cubic feet of volume of buildings per installed kilowatt:

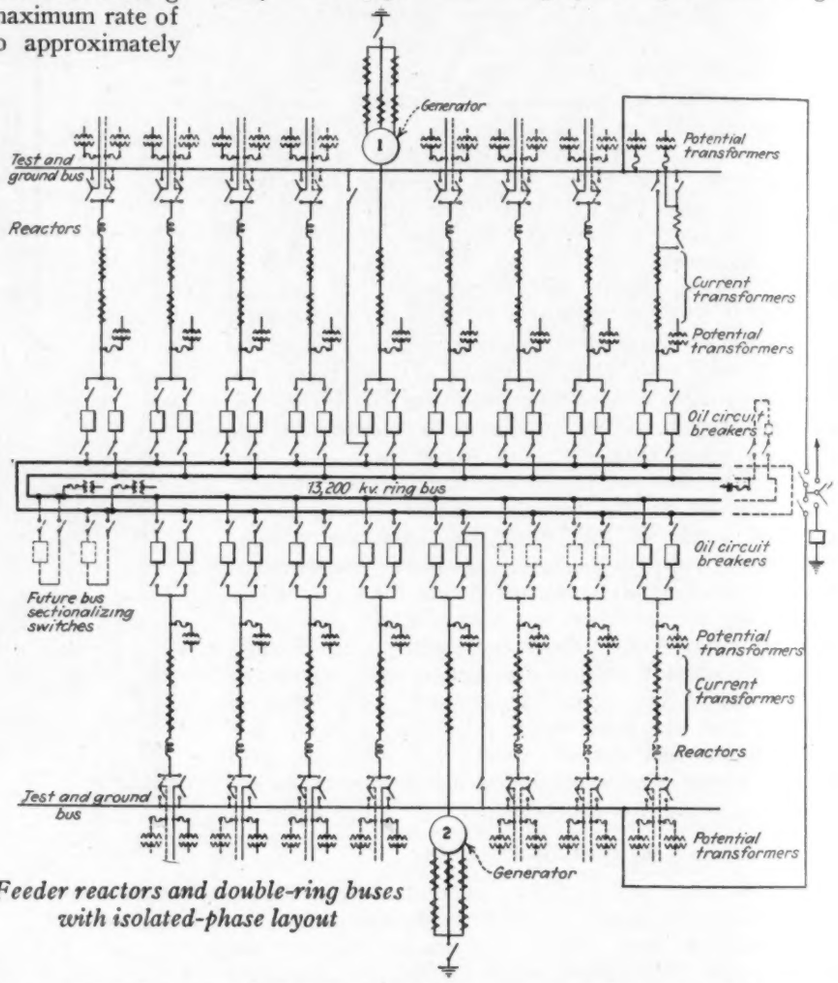
	Present		Ultimate	
Turbine room	0.1903	16.32	0.1523	13.06
Boiler house	0.2333	27.20	0.1400	16.33
Coal preparation plant	0.0776	5.51	0.0388	2.755
Switch house	0.0776	7.92	0.0388	3.58
Total buildings	0.5788	56.95	0.3699	35.725

which the air is removed. The pressure in the heater varies as the bled steam pressure varies. This heater is in the boiler house at an elevation of 80 ft. above the boiler feed pumps, which take their water from it. With a shell capacity of 6,400 gal. it serves as a closed surge tank. The only condensate in the cycle which comes in contact with air is the condensed drip in the after condenser, which passes through the deaërating heater on its way back to the boiler.

Make-up is supplied by a low heat level interstage evaporator of the vertical single-effect recirculating film type, using city water as feed at a maximum rate of 10,000 lb. per hour, corresponding to approximately



Hairpin type construction used for bleeder heaters and evaporators



Feeder reactors and double-ring buses with isolated-phase layout

2½ per cent of the total full-load turbine steam flow. Fifth-stage steam is used and the vapor is condensed in the evaporator condenser.

One five-stage motor-driven boiler feed pump of 1,000 gal. per minute capacity is provided for each main unit, with one spare unit of the same size for each group of two units so arranged as to be available for either. A steam-turbine-driven four-stage pump, serving as a boiler protector only, is installed.

Welded Piping Used

The single row of boilers parallel to the row of turbines makes for a very simple steam piping system. Steam is conveyed from single outlets on the Nos. 1 and 2 boilers to a four-neck manifold, from which is taken the No. 1 turbine lead and a tie to a second manifold. The second manifold is a duplicate of the first, with a connection from the No. 3 boiler and the No. 2 turbine in addition to a future manifold. Boiler and turbine leads are 16-in. outside diameter seamless tubing, designed for steam velocities of 9,000 ft. per minute at rated load. Sargol joints, 600-lb. standard, with serrated faces are used throughout, but valve flanges are made up with gaskets and not welded. An emergency closing valve was used on the No. 1 turbine lead, but it will be omitted on the second unit. Motor-operated stop valves are used with additional remote control stations on the turbine platform.

One main and one auxiliary header is used on the boiler feed system with one feed line to each boiler from each header. All feed lines are of seamless steel extra heavy iron pipe size. Eighty-five per cent magnesia insulation with a cement finish covered by 8-oz. army duck is employed throughout.

The generating voltage is 13,700 at the bus and about 13,300 at city substations, the nominal voltage at the point of usage being 13,200. From the power house the energy is carried through the cable tunnel to the isolated phase switch house by means of three 1,000,000-circ.mil lead-sheathed cables per phase. Insulation used on these cables is the standard for substation work, being $\frac{4}{32}$-in. thick, 30 per cent Hevea rubber and $\frac{12}{32}$-in. varnished cambric.

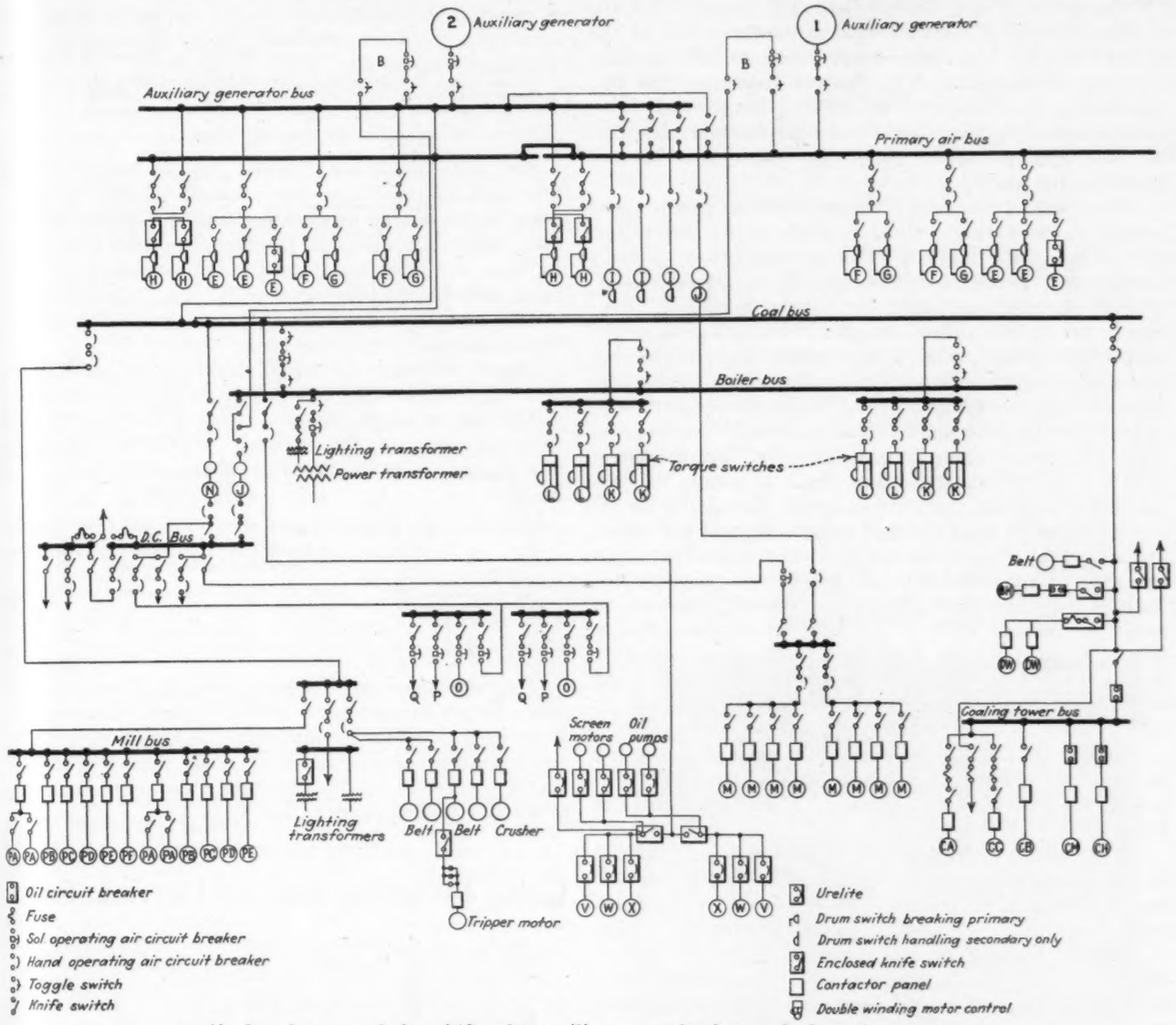
The switch house has a basement and six floors. The side aisles of the basement are used for the high-tension potheads, this being the first and only place the phases come together. The center of the basement has been reserved for a 4,000-volt distribution substation in the future. The first main floor has C phase equipment, the second carries B phase, and the third A phase. The operating mechanisms for the oil switches, bus disconnects and pothead disconnects are located on the fourth floor, together with the connections to the specially

calibrated instrument transformers used on the water rate test circuits.

The oil switches on the outer ring bus have a rupturing capacity of 40,000 amp., r.m.s. at 15,000 volts, based on the standard A.I.E.E. duty cycle, and they are built to operate on 15,000 volts, although standard 25,000-volt insulation is provided throughout. All generator and test bus tie circuits are equipped with 2,000-amp. which is only one-third or in some cases one-fourth of the rated rupturing capacity of the switch.

Each machine has its own exciter bus which supplies excitation to the fields of both the main and auxiliary generators. Power is usually fed into this bus from the shaft exciter, but an emergency supply is available from a 200-kw. motor-generator set.

Station auxiliaries are designed for 460 volts rather



Air breakers used for 460-volt auxiliary supply from shaft-end generators

B—Tie auxiliary generator to coal bus.
E—Drip pumps.
F—175-hp. circulating pump.
G—125-hp. condensate pump.
H—75-hp. primary air fan.
I—500-hp. boiler feed pump.
J—50-kw. motor-generator set.
K—200-hp. forced-draft fan.
L—550-hp. induced-draft fan.
M—5-hp. coal feeder motors.
N—200-kw. motor-generator set.
O—250-kw. exciter. *P*—Main field.
Q—Auxiliary generator field.
V—50-hp. service water pump.
W—50-hp. harbor water pump.
X—125-hp. harbor water pump.
PP—Preparation plant bus.
CH—300-hp. hoist motor.
CM—60-hp. trolley motor.
CB—100-hp. Bradford breaker.
CA—5-hp. apron feeder.
CC—Air compressor.
PA—1-hp. mill feeders.
PB—200-hp. mill.
PC—100-hp. mill exhauster.
PD—75-hp. transport pump.
PE—150-hp. air compressor.
PF—75-hp. drier exhauster.
DW—10-hp. dock winches.
BH—60-hp. barge haul.

apparatus, while the outgoing feeders have 600-amp. oil switches and disconnects.

The inner ring bus is equipped with switches having a rupturing capacity of 40,000 amp. on the generator and test bus tie circuits only. The feeder switches have a rated rupturing capacity of 30,000 amp.

Each three-phase feeder is equipped with three single-phase reactor coils, one on each phase floor, these coils having an impedance of ¾ ohm, which limits a dead short circuit or ground to a maximum of 10,000 amp., than 2,300, because the lower voltage motors were lower in cost and kept in manufacturers' stocks. It was felt that the lower voltage was also somewhat safer and could be handled well by carbon circuit breakers. Carbon circuit breakers occupy less space than oil switches that would be required for 2,300 volts. Their cost was lower and they are subject to inspection during operation as they are mounted on the front of the auxiliary switchboard. The fire hazard with oil switches is also avoided.

The supply of fuel and air to the boilers and the removal of gas is controlled by Bailey automatic equipment which governs the speed of the forced-draft fans, induced-draft fans and coal feeders. The circuits controlling the fans, feeders, etc., have been interlocked to shut down the equipment automatically in the event of failure of any part of the apparatus which might result in explosive mixtures in the furnace.

The induced- and forced-draft fan controls are the most unique in the plant. Due to the large size of the boilers and the high guaranteed rating of 550 per cent nominal rating, each of the boilers requires 1,500 hp., divided up as follows: Two 200-hp. forced-draft fans, which introduce fresh air to the combustion chamber, and two 550-hp. induced-draft fans which blow the hot gases up the stack.

The control for each fan consists of a low-speed secondary regulating resistance drum, a transfer switch for changing the number of poles by altering primary connections, a high-speed secondary regulating resistance drum, a balanced high-speed drum for the last five-speed points, a torque switch for starting and the necessary circuit breakers and relays for interlocking and automatic protection. This combination of apparatus provides approximately 55 speed points for each fan.

In order to start up the fans it is only necessary to push a button. When the automatic combustion control calls for more draft the drums begin to rotate, the primary circuit breakers are automatically closed, the torque switches revolve until the motor starts up and the drums are set on the desired operating point automatically. In the case of the induced-draft fans, stack dampers are controlled by the same combustion control drive and a range of natural draft is utilized before the primary breakers close and the fans start. The speed range of the induced-draft fans is from 110 to 870 r.p.m. and on the forced-draft fans the speed range is from 145 to 1,170 r.p.m.

Primary air fans are controlled by manually operated secondary regulating resistance drums having eleven points, five of which are balanced. Their speed range is from 700 to 1,750 r.p.m.

An elaborate system of interlocks has been provided to take care of emergencies in operating and to prevent situations which might cause an explosion of the powdered coal mixture in the boilers. Relay protection is provided to trip the fan circuit breakers on loss of 460 volts service. In case the two induced-draft fans are tripped the two forced-draft fans are automatically removed from the line to prevent the formation of positive pressure in the furnaces. If, at this time, the combustion control is still calling for mechanical draft, three of the four coal feeder motors are shut down.

The coal feeder motors are 5 hp., 250 volts, d.c., inclosed, and have a speed range of from 400 to 1,600 r.p.m. The 500-hp. boiler feed pumps are controlled by motor-operated drums having 36 points and a speed range of from 1,400 to 1,750 r.p.m.

The 125-hp. condensate pumps have 24-point hand-operated secondary regulating resistance drums with eight balanced points, giving a speed range of from 1,400 to 1,750 r.p.m. The 175-hp. circulators also have hand-operated drums with a speed range of from 175 to 350 r.p.m. in eleven steps, five of which are balanced.

Throughout the design of the Gold Street plant the object was to secure maximum reliability with minimum total costs per kilowatt-hour. By total costs is meant not only operating labor and superintendence, maintenance and fuel cost, but fixed charges on the investment. This criterion was used in the choice of apparatus, the cost of the apparatus being weighed against its ability to reduce production costs.

The actual cost of the first unit and the estimated costs of three additional units are shown in the following table (the estimated cost of the completed plant of 144,000 kw. being $88.26 per kilowatt):

	One Unit (Actual)	Two Units (Estimated)	Three Units (Estimated)	Four Units (Estimated)
1. Investment cost as per report of June 20, 1927...	$4,681,821	$7,396,224	$10,090,322	$12,709,909
2. Capacity, kilowatts.....	36,000	72,000	108,000	144,000
3. Cost per kilowatt.....	$130.05	$102.73	$93.43	$88.26

The wide spread between the cost per kilowatt of the first unit and the cost per kilowatt of the completed plant is due to the many items included under the first unit, which are designed for the completed plant, such as land, receiving platform for coal storage, coal handling, preparation plant, etc.

The capacities given in the above table are the net send-out capacity with four-stage bleeding.

Under two-stage bleeding conditions capacity is increased considerably and a net send-out capacity of 40,000 kw. is readily obtained, and will be obtained in the event of need, for peak-load conditions. Figuring this higher capacity the investment costs become as follows:

	One Unit (Actual)	Two Units (Estimated)	Three Units (Estimated)	Four Units (Estimated)
1. Investment cost as per report of June 20, 1927...	$4,681,821	$7,396,224	$10,090,322	$12,709,909
2. Capacity, kilowatts.....	40,000	80,000	120,000	160,000
3. Cost per kilowatt.....	$117.05	$92.45	$84.08	$79.44

The investment figures given include all expenses of every nature in connection with this plant, covering such items as preliminary engineering, old buildings used, interest during construction and during tuning up period, also a portion of the floating equipment of the company properly allocated to serve this plant.

Cable Pulled by Reel on Derrick Truck

THIS power-driven wire reel has been found to reduce time and labor greatly in removing large overhead cables and indicates one of the many uses for a 10-ton derrick truck utilized by the Northwestern Electric Company, Portland, Ore. The cable-pulling attachment can be removed easily and the derrick used for handling heavy material and equipment.

Proper Location of Disconnecting Switches Insures Safety

By W. Specht
Switchboard Engineering Department, General Electric Company

DISCONNECTING switch placements should be carefully planned if adequate safety is to be afforded operating men. Not only is the question of proper height involved but the width of aisles is also important. These values have been analyzed, and as a result the accompanying chart has been developed.

The curves inclose areas from which the safe location

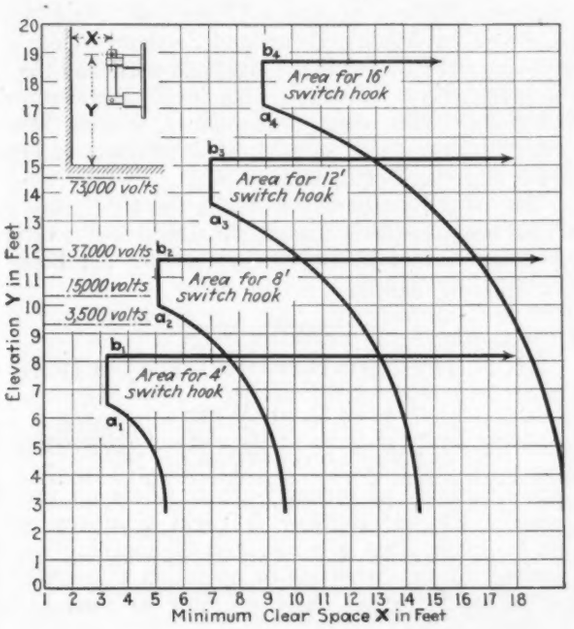


Chart aids in designing switch placements

of disconnecting switches using 4-, 8-, 12- or 16-ft. switch hooks can be determined. These areas are based on a minimum operating angle of 30 deg. from the vertical and a proper maximum and minimum height for the lower end of the operating hook, permitting the operator to use both hands even in the maximum position, thereby assuring easy and steady manipulation of the hook.

If the width of the aisle is given and therefore the dimension X is known (see upper left-hand corner of illustration) it is then an easy matter to determine the possible dimension Y by finding the value of X on the horizontal scale and following it vertically until the circular curve bounding the area corresponding to the switch hook used is reached. Between this point and the point where the line leaves the area, vertically above it, lies the possible dimension Y. Likewise, if Y is given, the minimum dimension X can be determined in a similar manner.

Assume that a 15,000-volt disconnecting switch is to be mounted in an aisle 6 ft. 7 in. wide, which will require the use of an 8-ft. operating hook. The distance from the wall, on which the disconnecting switch is mounted, to the eye of the blade is given as 11 in. What is the permissible Y dimension?

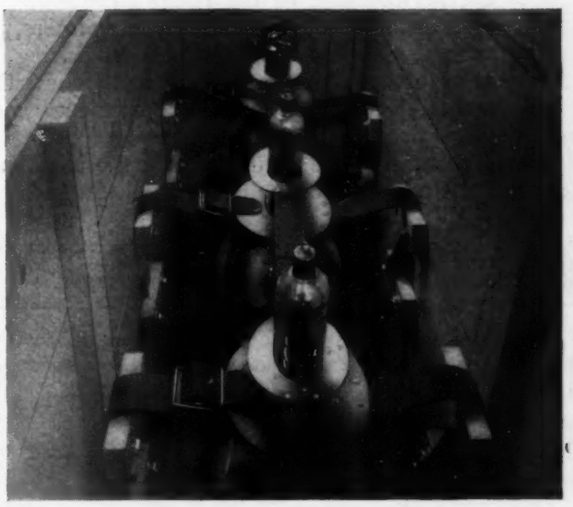
Taking the above dimensions into consideration, X is equal to 79 in. minus 11 in., or 68 in. (5 ft. 8 in.). Following the vertical at $X = 5$ ft. 8 in. it will be seen that the circular curve is intersected at $Y = 9$ ft. 8 in. and the horizontal line of this area (directly above) at $Y = 11$ ft. 8 in. This means that the disconnecting switches may be mounted with the Y dimensions between 9 ft. 8 in. and 11 ft. 8 in. and at both extremes can be conveniently operated by an 8-ft. switch hook. Values of X falling to the left of the vertical line indicate too narrow aisles.

Assume now that the height Y is limited, say, to 9 ft. 6 in. Then find the horizontal line corresponding to this dimension and follow it until it cuts the vertical or circular curve bounding the corresponding area (in this case for the 8-ft. switch hook). In the present case it will be found that the circular curve is intersected at $X = 6$ ft. 0 in., which is the minimum dimension. Of course, there is no limit for X maximum and therefore the areas in the illustration have no boundary on the right-hand side.

The marking along the vertical scale 3,500 volts, 15,000 volts, etc., are the minimum vertical dimensions Y for the voltages indicated when disconnecting switches need not be protected by barriers. This makes it easy to see whether barriers must be furnished after the Y dimension has been determined. For instance, in the last example with the Y dimension = 9 ft. 6 in. and a 15,000-volt disconnecting switch it is immediately seen that barriers are required.

Carrier for Kenotron Tubes

By R. W. Chadbourn
Department of Standardizing and Testing
Boston Edison Company



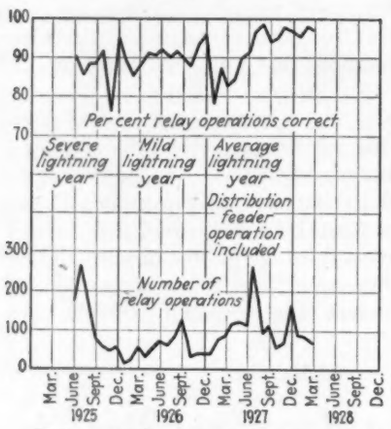
TO SAFEGUARD kenotron tubes against breakage during transportation in a portable testing unit recently built for the Edison Electric Illuminating Company of Boston a special box was constructed to carry five tubes in a vertical position, as shown in the accompanying illustration. Each tube is held in place by two short straps of canvas secured to the sides of the box. In the center of each strap is a round piece of leather with a hole cut to fit the end of the tube. The top strap has a safety buckle which permits its removal from the tube. The tube can then be lifted out of the hole in the lower strap. As a further safeguard a long strap runs longitudinally through the box and acts as an anchor for all five tubes.

Direct Benefit of Field Testing of Relays

By B. M. Jones
Equipment and Protection Engineer
Duquesne Light Company

THE direct benefit of field testing of protective relays is the improvement in the service rendered and the improvement in the operating performance of these relays with their associated devices, the first being by far the most important and the object for which all operating companies strive.

The accompanying graphic record shows the relay operating performance of the Duquesne Light Company from June, 1925, to and including the first quarter of 1928, and the benefit of the field relay testing improved correspondingly with the relay performance. The average for the portion of the year 1925 was 88.4 per cent, for the year 1926 91 per cent, for the year 1927 92.5 per cent, and for the first quarter of 1928 96.7 per cent. This percentage of correct performance includes the performance of the relays themselves, the current transformers, the potential transformers, the tripping battery, all control and switchboard wiring, the mechanical adjustment of the breaker and its auxiliary switches and all devices that go to make up the automatic circuit-interrupting device. This method of rating the relay performance is in accordance with the recommendations of the relay sub-committee of the A.I.E.E.



Relay performance improved since adopting field testing

With a simple transmission system the adequate relaying of the lines and equipment is relatively simple and field testing is not so important. However, with a complicated transmission system and the various complicated relay schemes that must be used, the matter of field testing becomes of utmost importance, and to the relay engineers and operating departments of our company this method is the most dependable means that we know of to assure the relays and associated devices being in the proper condition for isolating faulty equipment in the minimum time.

A large part of the improvement shown on the graph is derived from the testing of directional line ground relays by actually grounding the line. The article in the Electrical World of March 17 entitled "Field Testing of Relays," by Messrs. Evans and Salsbury of our company, describes in detail the methods used for the field testing of relays. The test plan involves the use of a truck-trailer with voltage regulators, circuit breaker, storage battery, water barrel load, instruments and auxiliary and control equipment.

It has cost some money to make the field relay tests, but our company feels that this investment has returned very large dividends, and such tests are not being restricted in any manner.

Mercury-Arc Rectifier Inspections

By O. M. Ward
Assistant Electrical Engineer Milwaukee Electric Railway & Light Company, Milwaukee, Wis.

INSPECTION of mercury-arc rectifiers on the Milwaukee Electric Railway & Light Company system must be made once a week, and if anything unusual is noticed during inspection or operation a verbal report must be made to the chief operator as soon as it is possible to do so.

The report form which follows is made out in duplicate, one copy being sent to the chief operator and the other kept at the station, so that the inspector may have the guidance of previous inspection:

Inspection Report for Mercury-Arc Rectifier Stations

Date.....

26,400-Volt Equipment:
Insulators. Are any broken?.....Do any show leakage?.....
Lightning Arresters. Condition.....
Disconnecting Switches. Is there any signs of heating?.....
Do switches show mechanical defect?.....
Fuses. For auxiliary transformers.
(Inspect every three months) .....
Date of last inspection.....Mechanical condition of fuse.....

Oil Circuit Breakers.
Date of inspection.....Was oil sample taken?.....
Date.....Oil sample to be taken every three mo.
Date oil was changed.....Were contacts inspected.....
Condition .....

Operating Mechanism. Oiled....Do any parts show wear?....
Which .....
Main Transformer and 50 Kw. Auxiliary Transformers.
Oil level .....Insulators cleaned .....
Is temperature normal? .....Connections .....

Rectifier. Insulators cleaned .....
Mercury Seal.
Is level correct?.....What was rectifier temperature?.....
Was ignition mechanism checked? .....
Date water chamber was painted .....
Date water was added to circulating system .....
Date alcohol was added .....
Date alcohol was taken out.....
Condition of hose connection .....

Vacuum Pump. Date oil was changed.....Packing.....
Motor .....Heating plate .....Bearings .....
Vacuum gauge .....Contacts .....Resistance .....
Motor Circulating Pump Bearings. Packing.....
Thrust bearings.....Water connections.....Motor.....

Fan. Motor .....Bearings .....Bearing oil changed.....
Date fan started .....Date fan stopped .....

A.C. Relays. No..... No..... No..... No..... No.....
Res. for relay .....
Contacts .....
Mechanical Oper.....
Time delay relay setting .....
Indicate if any relay settings have been changed.....
.....
.....

Excitation Transformer and Automatic Equipment for it.
Are there any signs of heating?.....
Were connections checked? .....
Date cleaned.....Was ignition coil checked?.....

600-Volt D.C. Equipment:
Circuit Breaker. Mechanical operation.....
Main contacts.....Operating coils.....
Auxiliary contacts .....Resistance .....
Are lockout signals O.K.?.....Any lamps burned out?.....
Relay No. 13 .....
Relay No. 12 .....

Wattmeter Readings. To be taken once each month.
Date ..... Reading ..... Constant .....
Veeder Counter Readings. To be taken weekly. Date taken....
D.C. Breaker. Present reading...Previous reading...Diff....
A.C. Breaker. Present reading...Previous reading...Diff....
Condition of Building. Report monthly .....
Remarks. Report any unusual conditions.....
.....
.....
.....
Inspector.....

Operating Experiences

*at Gould Street Station**

Performance obtained during initial operation of the new station of the Consolidated Gas, Electric Light & Power Company of Baltimore and methods adopted to overcome usual preliminary troubles

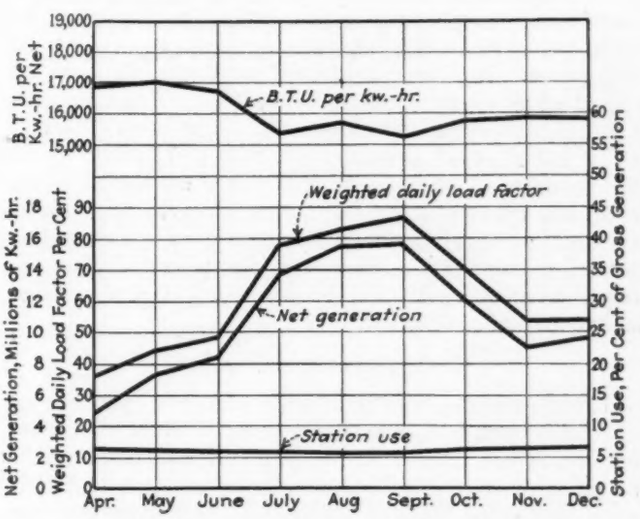
TROUBLES which have developed in the coal-handling equipment of the new Gould Street station of the Consolidated Gas, Electric Light & Power Company have not resulted in any great amount of inconvenience. Of major importance was the failure of some parts used in propelling the airplane tripper and its unloader belt, the drive being from the main conveyor belt by means of gearing and clutches. One of these failures resulted in a runaway condition, with considerable damage narrowly averted. The weakness was obviated by adopting a cable-haulage arrangement actuated by a separately controlled motor.

A pulverized-coal system handling wet coal is subject to many ills, and it is difficult to obtain proper flow at many of the points where gravity is the moving force. Very unsatisfactory grinding is obtained with wet coal. After the coal is ground, some of it forms a pasty mass and sticks at almost every conceivable point. A mucky mass very often collects in the mill, choking up the air passages. Vent lines become choked. Cyclone separator discharge lines become plugged. Transport pumps and lines become plugged. The coal cakes in the pulverized coalbins and arches over the feeder screws at the boiler, causing burners to become extinguished. Even the burner pipes become so choked that in many cases it is necessary to take pipes down for cleaning, as rapping on the pipe is often ineffective. There is also much difficulty from irregular feeding of the coal to the furnaces, which greatly reduces the furnace efficiency.

The steam-heated grid type driers originally installed were found to be inadequate for our conditions. As already explained, the delivery of fine coal to the drier resulted in arching and inability to get the coal to flow through the drier. There was also additional trouble due to the pulling along of considerable coal by the air used to remove the moisture. A large amount of air is necessary, and while it was put through a cyclone separator, the separation was incomplete, causing a considerable loss of coal. The coal recovered in this cyclone separator was discharged into the hoppers of the transport pumps. There was the additional objection that much of this coal was coarser than desired. Some of the drier grids were removed to better these conditions. While feeding was bettered, drying was less complete.

Furthermore, the amount of moisture removed was not so great as was necessary for the satisfactory milling and handling of the coal. Failure in this respect caused the consideration of other means of obtaining the desired result. We believed that the most reasonable scheme would be that of drying the coal, which is in a finely divided state, in the air circulatory system of the pulverizing mills, and that it should give up its free moisture very readily. Due to the relative locations of the mill house and boiler room, it was not feasible to use either stack gases for supplying the heat required or the air vented from the mill system for primary air. Accordingly, it was decided to heat the make-up air by means of high-pressure steam, so as to obtain the maximum temperature, thereby permitting us to supply the necessary heat with a minimum of air. This permits of using apparatus that is much more compact and reduces to a minimum the amount of fine coal that is lost in the vented air. The mill drier is not effective in drying the coal until it enters the mill, and this, of course, does not help the flow of coal to the mill. High moisture, however, has caused no appreciable difficulty in feeding the mills, since the grid driers have been removed. The mill drying system is performing very satisfactorily and has practically eliminated the many annoyances incident to wet coal. In regular operating practice the mill drier has been successful in reducing the moisture content of the coal from 6 per cent entering the mill down to 1.7 per cent leaving the mill.

The air washer as originally installed for use with the grid type driers did not remove the coal dust to a sufficient degree. It was also inadequate when the mill



Nine months' records at new Baltimore station

Attention was concentrated on securing dependable operation and not on output.

Abstract of paper by A. L. Penniman, Jr., and F. W. Quarles of the Consolidated Gas, Electric Light & Power Company, presented at the regional meeting of the A.I.E.E., Baltimore, April 18, 1928.

type drier was put in commission. In order to obtain satisfactory removal, it was necessary to increase both the amount of steam and water used. At the present time approximately 1,150 lb. of steam and 2,000 gal. of water are used per hour, with a dust concentration of about 0.8 grain per cubic foot of air entering the washer, the amount of air handled being approximately 1,240 cu.ft. per minute.

Mills Work Well

On the whole, the pulverizing mills have performed very satisfactorily, although, of course, there is considerable wear of the grinding rollers and bull ring of the pulverizing mills and of the blades and wearing plates of the mill exhausters. These mills, designated by the manufacturer as of 20 tons per hour capacity, have pulverized at an average rate slightly in excess of 24 tons per hour each, the coal leaving the mill having an analysis about as follows:

Moisture	0.76 per cent
Volatile	25.28 per cent
Fixed carbon	63.76 per cent
Ash	10.20 per cent
Sulphur	2.02 per cent
Amount through 200-mesh sieve	74.2 per cent
Amount through 100-mesh sieve	89.4 per cent
Retained on 40-mesh sieve	0.4 per cent

At times there has been some difficulty experienced due to coal hanging up in the cyclone separators or in faulty delivery to the hoppers of the transport pumps, because of improper functioning of the flappers of check valves or the choking of vent lines from hoppers to suction pipes of mill exhausters. One other difficulty is the collecting of a mucky mass of coal and water in the chamber of the mill that receives the air returned from the cyclone separator. A muck-collecting pocket installed on one of the mills served to alleviate this condition somewhat. However, the better drying obtained when the mill type drier was installed eliminated all trouble of this nature.

Coal Transport System

There was considerable trouble with the operation of the pulverized-coal transport system when the plant became active. Most of the difficulties resulted in the plugging of transport lines, which, being new and rough, were accredited with the responsibility for part of the troubles. The starting up of this system occurred during cold weather, and this, in conjunction with the faulty performance of the driers, was responsible, no doubt, for the greater portion of the plugging. Also, the size of the hoppers above the transport pumps was thought to be too small for even delivery to the screws of the pumps and partially responsible for the pumps plugging. Accordingly, they were increased in size by adding height with filler pieces having rectangular openings to conform to the hoppers. It was discovered that considerable water collected in the cylinders of the pumps after being shut down several hours. Keeping the pumps drained was the logical answer to this difficulty. Increasing the air pressure on the nozzles of the pumps also helped to keep the boilers supplied with coal. Later, when the transport lines were worn smooth and the mill drier system was in service, trouble with the transport system practically disappeared.

Coupled with the difficulties of pumping the coal was the difficulty of the sticking of the transport line switching valves. This was alleviated somewhat by applying brass liners to the valves. This has not been an absolute remedy, as it is necessary to operate the valves frequently, and even then occasionally to dismantle them for complete cleaning. A careful analysis of the factors involved is now under way and it is hoped that this will result in eliminating any abnormal routine operation of the valves to prevent their sticking.

The amount of power used in the grinding and transporting of the pulverized coal averages approximately 19.6 kw.-hr. per ton of 2,000 lb. The expenditure for the maintenance of pulverizing equipment has been approximately 13.9 cents per ton.

Boiler Room Operation

The greater amount of effort for tuning up and making structural changes to approach or exceed design conditions has been put forth in the boiler room. While efforts have been made to hasten the process, at this date there are several matters that have not been brought to a satisfactory state.

At the outset considerable difficulty was experienced with poor feeding of the coal due to insufficient drying and condensation on the walls of the bunkers. It frequently became necessary to empty a bunker of the coal which would flow and then have men enter the bunker and scrape down the pasty masses of coal clinging to the walls and arched over the feeder screws. This condition was eliminated almost entirely by the mill type drier when it was put in operation. Since our early experiences, No. 1 bunker has been covered with heat-insulating material and an investigation has been made on No. 2 bunker by forcing preheated air over the coal from one end to the vent at the opposite end to reduce the humidity of the air over the coal. The use of hot air results in less condensation on the walls, but there also is an increase in the amount of coal lost out of the bunker vent. A combination of heat insulation with the use of hot air would probably give a still better feeding performance.

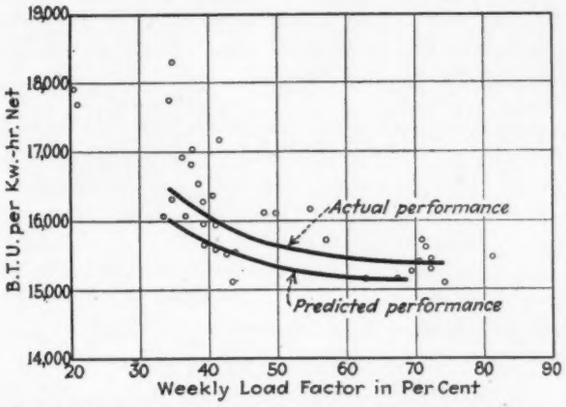
With the coal-feeding equipment originally installed it was impossible to reach the maximum designed capacity, part of the fault being insufficient motor speed. However, sufficient coal could not be supplied after the motor speed was increased to that designated. New screws, having a considerably greater capacity, were furnished for one boiler. These screws caused flooding to take place at lower ratings, resulting in very dense smoke and, in one or two cases, in the loss of much coal to the ash hoppers. Also, these screws had so much capacity that it was considered advisable to abandon them and hob out the original screws. Flooding also took place on these modified screws, and to eliminate this spring-loaded disks were applied to the discharge end of the screws to provide a uniform resistance to the coal being fed. These very successfully reduced the pulsations experienced with the feeders having greater capacity than the original.

The controls of dampers in the various ducts were originally unsatisfactory, in that it was possible for sudden changes to occur if the hand slipped on the operating chains. In the case of the primary air system, a damper got out of control and was responsible for an explosion occurring in the furnace of No. 1 boiler, this explosion resulting in bulging of the steel casing and the bending of several side-wall tubes. By applying worm wheels and sectors to these dampers the control has been made positive and easier to manipulate.

In order to guard against future explosions displacing

the furnace sides, a horizontal steel buckstay was applied around the middle of the furnace for additional strength, as it was assumed that the air and gas passages should furnish sufficient relief for the expansion of the products of combustion resulting from such explosions. The boiler control, also, was provided with some features to eliminate some of the provoking causes of explosions. Furnace contactors were provided to trip out three of the four coal feeder motors per boiler on the occurrence of excessive furnace pressure. Primary air pressure contactors were arranged to trip out the same three feeder motors and to turn on the steam to the burner aspirators on the occurrence of low primary air pressure. The forced-draft fan control is arranged to trip if both induced-draft fans are tripped. Since these modifications have been made no occasion has arisen necessitating their functioning.

Changes have been made in the burner design with respect to what is termed the tertiary air; that is, the heated air which is forced downward around the burner nozzle. These changes have been made with the idea of producing a longer downward sweep of the flame with less and hotter primary air. The present indications are that the new arrangement is very beneficial.



Predicted and actual performance at Gould Street

The points plotted for actual performance show quite a wide variation, not only because of the changes made in the plant during the year, but also because comparatively small error in estimating coal causes a large error in consumption when consumption is least. It is expected that the installation of automatic coal scales to weigh the coal entering the mills will greatly decrease this error.

Experimental observations were resorted to in order to obtain a better distribution of air across the furnace. The number of port openings in the front wall was substantially reduced, which, by proper selection of the ones to be closed off, improved the distribution, produced greater turbulence and also made available a higher tertiary air pressure. It was then possible to exercise more control over the tertiary air.

The spring-loaded dampers governing the flow of secondary air to lanes in the front wall have performed unsatisfactorily at times and it has been necessary to provide hand control to those governing the air admitted by the four uppermost lanes. It is now considered desirable to have all of the spring-loaded dampers operated by hand from the main boiler floor.

Some difficulties have been encountered with slagging of the lower rows of boiler tubes. This slagging usually occurred after the boiler had been carrying about 400 per cent rating continuously for 48 hours or longer. Little trouble was experienced when less load was carried at night than in the daytime, and it has been noticed that much slag which had accumulated when operating at high rating fell off when the rating was reduced for several hours. On one of these occasions when a high rating had been maintained for longer than 48 hours an attempt was made to cause the slag to drop by increasing the excess air, but this apparently had little effect. One proposal advanced to prevent this trouble was to remove every other tube in the bottom row of boiler tubes, which would mean that the spacing of this bottom row would then be approximately the same as that of the water screen and, consequently, slagging would be greatly reduced. The boiler manufacturer has recommended against removal of these tubes and, instead, suggests removing every other tube in the lower row and installing deformed tubes which would have a drop of 7 in., thereby accomplishing the same result with no loss in heating surface.

The air heaters are arranged with straight vertical flue gas passages and U-shaped air passages, the air entering and leaving on the same side of the heater, thereby providing very unequal resistances to flow in the air lanes. The result of this was a wide spread in the air temperatures leaving the air heater, there being about 200 deg. F. temperature difference between the top and bottom of the duct discharging air from the heater. A deflecting-type baffle was applied to guide the air toward the lanes having the longer paths. Another scheme which was also experimented with consisted of adding resistance at the air inlet to the shorter paths, the increased resistance to flow of air being obtained by the application of metal strips. The two schemes materially helped the situation and were of about equal merit, although neither attained the desired result. Both schemes are objectionable from the standpoint of power loss caused by the increased duty placed on the forced-draft fans. The air heater manufacturer is now taking the necessary steps to improve the performance of this apparatus.

The bearings on the primary air and induced-draft fans are of the ring-oiled type, provided with an integral oil cooler built into their bases to eliminate the necessity of separate oil pumps for the circulation of the oil and also to permit the use of harbor water for cooling. There was some trouble from the leakage of water into the oil reservoirs, which was eliminated by a slight change in the design of the coolers.

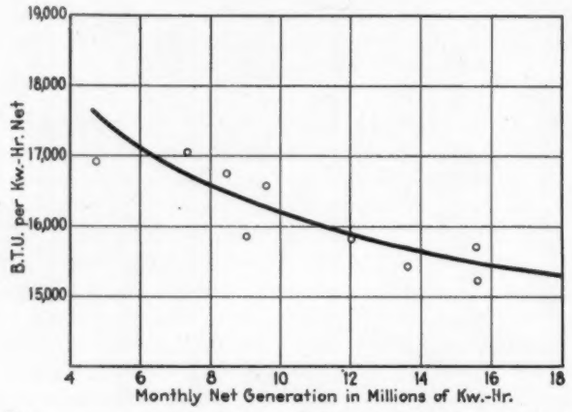
The induced-draft fans are of the plate type because of the high duty imposed by the requirement of handling 135,000 cu.ft. per minute of 450-deg. F. gases against a static head of 15.8 in. of water. These fans have given excellent service except for some slight vibration due to the bearing pedestals being somewhat light. This has been corrected by the application of bracing. Two failures of an induced-draft fan motor have occurred, the reason for which cannot be ascribed to overload or faulty control.

Five failures of fin tubes constituting the back furnace wall have occurred. These tubes have all failed in the same manner and almost at the same spot, namely, the outside of the top bend of the rear wall tubes near the sides of the furnaces. In one case a large bulge was noticed before an actual rupture occurred. The water circulation is to be investigated to determine whether or not there is considerable difference in rapidity of water circulation in different parts of the back wall. The obtaining of this information will no doubt make possible a satisfactory analysis of this condition.

Because of the high rating for which these boilers

are designed, it was necessary to supply two 6-in. feed-water regulating valves. It was found that the thermostatic tubes of the feed-water regulators were not sufficiently powerful to operate the valves properly. New pistons were designed by the manufacturer in an effort to reduce the friction, which was apparently caused by water flow, since the friction was quite low when no water was flowing through the valves. The new pistons did not prove entirely satisfactory and attention was directed toward the use of hydraulic power, utilizing the thermostatic tube to actuate only a pilot valve. Operation was so much more satisfactory that the manufacturer equipped all the regulators similarly.

Soon after starting the plant it was determined that the moisture content of the steam leaving the boiler drums was higher than desirable. The boiler manufacturer has developed and installed a new type of baffle



B.t.u. per net kw.-hr. at different monthly outputs

which has produced excellent results. This improvement should be of much benefit in the maintaining of cleaner surface on the interior of the superheater tubes, since the moisture, of course, carries solids in solution. It also will reduce the duty on the superheater for a given temperature of steam leaving the superheater.

The plant operated for a large portion of the year 1927 with lower superheat than the design value. It was held advisable to delay the raising of the steam temperature until other apparatus which would influence the result had been tuned up. Just recently the baffling of the gas passage at the superheater has been changed to give the desired steam temperature. The remaining feature to be reckoned with is the pressure drop of the steam through the superheater, this being approximately 35 per cent higher than expected.

As to the matter of combustion control, several difficulties were experienced in the burning out or breaking down of coils and grounding of wiring. Discharge resistances were provided to lessen the inductive kick from the coils and wire with varnished cambric insulation was used in the control boxes to withstand the oily atmosphere. The pole-changing feature of the motors contributed some complications on account of the necessity of providing control overlap.

The combustion control is normally set to maintain a 15 per cent CO_2 average across the section of the boiler gas outlet. This setting is interfered with to some extent by a variation in feed water temperature. This is particularly so if the two higher pressure feed-water heaters are cut out of the circuit at 20,000- to 35,000-kw. load on one boiler. An attachment has been designed quickly to correct the meter for this condition and is being installed. The combustion control which we have installed is not suitable for quick changes in load, this having been demonstrated several times. It is our usual practice to operate on semi-automatic control for the quick changes in load which can be anticipated, such as the noontime drop and the morning pick-up.

There are eight 4½-in. high-lift safety valves on the drum and two on the superheater outlet of each boiler, each drum valve having a relieving capacity of 52,500 lb. per hour and each superheater valve 35,000 lb. per hour. While these valves have not been tested for relieving capacity, two occasions have arisen when the entire plant load has been lost in which the safety valves relieved a total of 380,000 lb. per hour satisfactorily. One of these occasions was when an air drill penetrated the high-voltage leads from the main generator, causing the differential relays to trip out the oil switch and field breaker, the other when the throttle valve of the main unit became unlatched. The leakage and maintenance of these valves has been very slight and, as a matter of fact, has not been any higher than has been experienced at the Westport plant on 200-lb. pressure service.

There are three ash gates per boiler, 41 in. x 56 in., actuated by oil-operated cylinders which at times have refused to move due to friction, distortion and failure of cast-iron plates. In certain places where two ferrous materials rub on each other, one of them has been replaced by non-ferrous material, clearances have been increased and the cast-iron support plates have been reinforced with steel. The result has been almost complete elimination of the sticking difficulties.

Turbine Room

Since No. 1 turbine was placed in operation slight trouble has been experienced with it. On one occasion sticking of the primary control valve stem occurred. This stem was made of "Ascoloy" and slides in a Monel bushing. These two metals apparently are not very satisfactory for sliding contact. The Ascoloy stem was replaced with one of medium-carbon machinery steel and the bushing enlarged to give a greater amount of clearance, the packing being relied upon to serve partially as a guide. It is contemplated that an Ascoloy stem will again be used, but with a cast-iron bushing so contained in a steel cage that the cast iron will not be able to break up and go through the turbine. Another difficulty which was experienced soon after the turbine was started up the first time was undesirable vibration of the throttle and control valves. This was remedied by the elimination of undue play at certain points and the redistribution of the weight of the pipe, control and throttle valves among several hangers.

The main condenser, while of somewhat radical design, in that the tubes are rolled into the tube sheet at both ends, has given but little trouble. The noticeable leaks which have occurred have been very few. In spite of the fact that the circulating water is high in salt content, we have been able to maintain the solids in solution in the condensate at a very low value. Computations made before the plant was put in commission indicated that if the leakage was as high as usually obtained with packed tube condensers it would be necessary to blow down the boilers very frequently, or continuously, in order to maintain the boiler water concentration at as low a value as was considered desirable. The following figures are indicative of the

purity of the condensate as usually obtained: Total solids, two parts per million; electrical resistivity, 1,000,000 ohms per cm.-cube.

While the dip cells used in determining the electrical resistance of the condensate are subject to erratic behavior at times, the electrical resistance characteristic has been of great help in showing relative performance, because of the rapid change in resistance for a small change in the amount of leakage. Only one leak of consequence has shown up, this one apparently being due to a condenser tube not being rolled in at one end, the flare serving to keep the leakage down for a long time.

The circulating pumps originally furnished required too much power because of the water quantity pumped exceeding the design value and, in order to lessen the load on the motors, it was decided to turn down the impellers.

One trouble which has been had with the steam-jet air pump intercondenser has been the erosion of tubes from the discharge of steam from the pipes used to vent some of the bleeder heaters. Some tubes were removed and a baffle installed to decrease the velocity of the steam hitting the tubes.

The difficulties experienced with the closed bleeder heaters has been confined mainly to those under boiler feed pressure, the most annoying one being the leaking of gasketed joints. Some of this was a result of poor machining. Remachining and the use of different gasket material have eliminated this annoyance almost entirely. One other source of annoyance has been the leaking of a porous, cast-steel water box, which is to be replaced by the manufacturer. The eighth-stage bleeder heater is of the deaërating type and has given no operating troubles. It has delivered water having less than 0.05 cu.cm. per liter of oxygen.

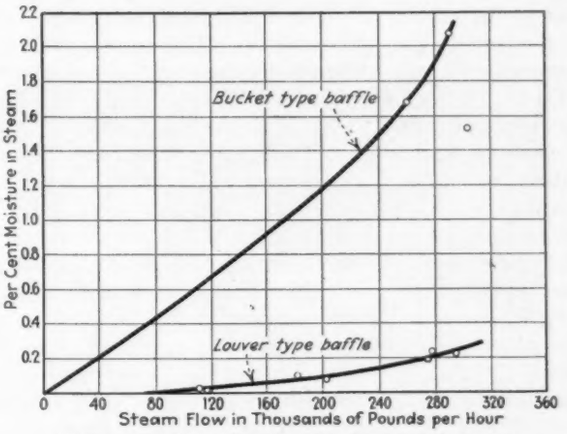
As originally furnished, the evaporator, while its capacity was all that was expected, did not produce a distillate measuring up to the standard required. Considerable experimental work was required before this standard was attained. We were fortunate during this time in having a boiler operating in the old plant supplying steam for heating purposes. Thus, the heating boiler acted as an evaporator and the heating system as an evaporator condenser. The quality of the water obtained in this manner was good and the amount was great enough for make-up purposes. The changes in the design of the evaporator were completed at about the time that the heating season ended. The evaporator is now producing water of the following quality: Total solids, 3.4 parts per million; electrical resistivity, 227,000 ohms per cm.-cube.

With low condenser leakage and water of this quality we have been able not only to hold the boiler water concentration to a low figure but have not been required to blow down the boilers at all on account of concentration, the concentration not having exceeded 500 parts per million.

While the boiler feed pumps are boiler auxiliaries, we are treating them under the head of turbine room equipment, since they are actually in the turbine room and are connected in between the low- and high-pressure bleeder heaters. The motor-driven boiler feed pumps have given but little trouble structurally. On one occasion there was a cessation of pumping, which appeared to be due to vapor binding. This was ascribed to hot water discharged from the evaporator condenser drip pump being fed to the suction side of the boiler feed pump. While there was an economic advantage to the scheme from the standpoint of heat efficiency, it was considered to be outweighed by the demand for safe operation and, accordingly, this water was delivered to the eighth-stage heater. Since then no further trouble of this nature has occurred. A shifting of the impellers and balancing drum occurred on the emergency steam-driven boiler feed pump. This was apparently due to the wearing sleeves turning enough to allow the shift to take place. When repairs were made these sleeves were driven up hard and locked so that this trouble is not expected to occur again.

Over-All Performance

Whereas the plant delivered power to the bus for the first time on Jan. 4, 1927, the amount of generation for the first three months was comparatively small, because of the decision to concentrate attention on those details which most affected the dependable operation of the plant.



Effect of changing baffles in steam drum

Two curves are shown, one of which is that of the predicted performance of the plant in B.t.u. required per net kilowatt-hour of station sendout plotted against weekly load factor in per cent; the other curve is that of the weekly performance in B.t.u. actually used, plotted in the same manner.

Conclusions

From this outline it is apparent that the plant has been subject to the usual minor changes and adjustments during the initial period of service. None of the troubles experienced were insurmountable and can all be traced to the fact that most of the equipment affected was of the largest sizes that were obtainable, operating in many instances at rather high capacities. This introduced some problems that were entirely new, it being necessary for the manufacturers supplying equipment to do a certain amount of development after their apparatus was placed in service. While such a procedure is necessarily slow, it is felt that the manufacturers affected have made a very satisfactory record in solving their individual problems and in making necessary changes and connections.

The actual performance has approached fairly close to the anticipated, and it is apparent that, when the air heater performance is improved and the effect of the recent increase in steam temperature is realized, the anticipated performance will at least be met and possibly slightly bettered.

Data on 100,000,000-Kw.-Hr. Systems

"Electrical World" shows United States has 124 systems each with annual output exceeding 100,000,000 kw.-hr. They generated 64,380,010,246 kw.-hr. in 1927

GROWTH in output of individual companies, a continuation of the process of consolidation of smaller units or groups into larger systems, a rising percentage of the nation's output from these larger systems, and an increase in energy generated per unit of installation are revealed by a comparison of the returns from the annual surveys of systems with more than 100,000,000 kw.-hr. output annually made by the ELECTRICAL WORLD. Details to the extent of about 7,200 items are given in the supplement to the present issue. The results are briefly summarized in the tables on this page.

Of the large light and power systems on the North American continent, 124 are in the United States, fifteen in Canada, and two in Mexico. In addition, fourteen railway systems fall, by virtue of their size, into the same classification. The 124 first mentioned operated 1,423 plants with a total rating of 24,275,311 kva., divided into 17,255,891 kva. in fuel-burning plants and 7,019,420 kva. hydro-electric. These plants generated 64,380,010,246 kw.-hr. during the year; 9,227,208,954 kw.-hr. was added by purchase, making an aggregate output of 73,607,219,200 kw.-hr. The energy generated by all electric light and power plants was, according to the latest revision, 74,753,227,000 kw.-hr. The present survey, therefore, accounts for 86.2 per cent of that total; the aggregate output, including purchase, is almost equivalent to the energy generated by the entire industry, though it must be noted that this aggregate necessarily involves duplication because of resales.

In 1926 the major companies generated 58,073,674,401 kw.-hr. in plants aggregating 22,559,063 kva.* The kilowatt-hour increase is about 11 per cent, and the energy generated per kilovolt-ampere rose from 2,570 to 2,610 kw.-hr.

For the first time a decrease is noted in the number of systems, from 126 in 1926 to 124 in 1927, notwithstanding the addition of ten new names for which no comparable earlier figures could be published, as well as several other cases where a new name could be more or less closely identified with properties previously listed. These additions were more than balanced by absorptions, consolidations and eliminations made to avoid duplication of statistics. The details can be ascertained by reference to the supplement, in particular the copious footnotes and sidenotes there given. It should be noted that in this compilation, as in earlier ones, a system may consist of more than one company provided all are operated as a single physical unit under a common management. Thus the trend toward co-ordinated operation, often followed later by actual financial amalgamations, is reflected in the data showing fewer but larger systems.

The number of systems with more than 1,000,000,000 kw.-hr. output has risen to 21, three more than in the preceding year. Their combined output was 39,671,078,953 kw.-hr., or considerably greater than that of all the rest put together. The leaders, in order, are the Buffalo, Niagara & Eastern system, the Commonwealth Edison of

*This is 500,000 kva. lower than the figure published in the issue of April 30, 1927, the Mohawk-Hudson system having been incorrectly credited with 711,600 instead of 211,600 kva. in hydro.

Table I—Generator Rating and Output of Systems Reporting More Than 100,000,000 Kw.-Hr. During 1927

(Summary of detailed tabulation in the supplement to this issue of the ELECTRICAL WORLD)

Section	Number of Companies or Systems	Number of Generating Plants and Generator Rating — All Plants — No.	All Plants — Rating Kva.	Fuel Burning — No.	Fuel Burning — Rating Kva.	Hydro-Electric — No.	Hydro-Electric — Rating Kva.	Energy Generated, Kw.-Hr.	Energy Purchased, Kw.-Hr.	Total Energy Output, Kw.-Hr.
United States	124	1,423	24,275,311	801	17,255,891	622	7,019,420	64,380,010,246	9,227,208,954	73,607,219,200
New England	14	79	1,718,644	29	1,365,254	50	353,390	3,484,486,229	633,510,195	4,117,996,424
Middle Atlantic	22	202	6,361,855	112	5,022,164	90	1,339,691	18,459,317,374	2,763,764,151	21,223,081,525
South Atlantic	12	170	2,463,461	89	1,543,635	81	919,826	5,223,811,976	724,268,924	5,948,080,900
East North Central	28	283	5,858,279	159	5,513,989	124	344,290	15,591,010,363	1,892,726,792	17,483,737,155
West North Central	8	100	1,687,668	56	1,269,368	44	418,300	3,917,579,371	80,728,870	3,998,308,241
East South Central	9	133	1,580,300	100	734,603	33	845,697	3,666,989,018	1,130,226,702	4,797,215,720
West South Central	11	206	757,418	197	742,486	9	14,932	2,167,289,548	349,823,896	2,517,113,444
Mountain	5	80	842,824	14	140,737	66	702,087	2,799,640,555	196,260,849	2,995,901,404
Pacific	15	170	3,004,862	45	923,655	125	2,081,207	9,069,885,812	1,455,898,575	10,525,784,387

Table II—Allocation of Output of Major Systems in 1927*

(Based on detailed tabulation in the supplement to this issue of the ELECTRICAL WORLD)

Region	Energy Sales in Millions of Kilowatt-Hours — Residential	Commercial	Municipal	Power	Railways	Other Public Utilities	Miscellaneous	Unsegregated Output	Per Cent of Energy for Intracompany Use and Losses
United States	5,230	5,540	2,010	33,698	5,199	7,388	356	2,091	16.4
New England	303	429	97	1,683	155	767	63	.....	15.1
Middle Atlantic	1,560	1,706	492	10,165	1,659	2,296	39	363	14.1
South Atlantic	256	274	104	3,014	232	132	11	1,095	17.1
East North Central	1,567	1,478	321	7,836	1,796	1,754	43	.....	15.3
West North Central	336	400	153	1,822	259	356	6	.....	16.7
East South Central	215	267	55	2,108	54	1,085	19	.....	20.5
West South Central	150	164	98	1,180	127	339	7	.....	18.0
Mountain	125	110	47	1,942	71	220	4	.....	15.9
Pacific	718	712	643	3,948	846	439	164	633	24.5

*To avoid misleading totals, approximate allocations have been made of sales of several companies which reported combined figures for more than one class under a single head. In a few instances sufficient information was not available to permit the making of reasonably close approximations. These are summed up in the column "Unsegregated Output."

Chicago, which has the distinction of alone reporting more than 1,000,000 kw. in plant, and the Edison-United of New York, which is also next in order as to plant, with 972,225 kw.

Power sales account for about 33,698,000,000 kw.-hr., nearly 46 per cent of the total output and more than three times the sales directly for residential and commercial lighting. In addition, more than 2,090,000,000 kw.-hr. is sold to municipalities, of which the larger part is no doubt ultimately used for lighting in one form or another. About 10 per cent of the output goes to other public utilities. This item, with its companion "purchased energy," reflects the economies of interconnection and of service from transmission lines replacing previously operated small plants. Railroads are credited with about 5,200,000,000 kw.-hr. This should be augmented by railway loads of unstated magnitude included, in some reports, under other heads, and by energy used by company-owned railways, reported by some companies with intracompany use. These figures unavoidably involve some approximations to allocate energy not completely segregated in the reports, but with this qualification the relationships shown in Table II are believed to be representative.

Losses and energy consumption by the companies themselves vary widely, depending on local conditions. They are, in general, larger in those regions having long transmission distances, either because remote sources of water power are used or because the load centers are widely scattered. The national average of energy thus absorbed is 16.4 per cent of the output.

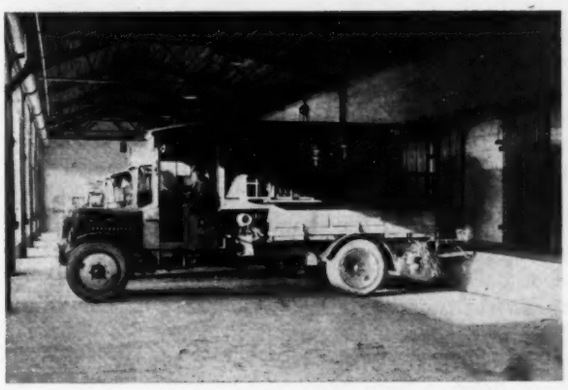
This year fifteen Canadian companies appear; they generated 11,895,292,334 kw.-hr. and purchased 2,491,824,655 kw.-hr. Last year's list contained but ten, with an output, generated and purchased, of 9,594,982,322 kw.-hr. The gain is due both to marked growth of previously existing systems and the addition of statistics for several not before available. Mexico has two, with a combined output closely approaching 754,000,000 kw.-hr. The heavy predominance of water power in these two countries is noteworthy: Canada has 2,711,284 kva. in hydro, against only 79,750 in fuel plants; Mexico's two companies had 220,660 hydro and 16,500 kva. in fuel-burning plants.

In addition to the light and power systems there are fourteen railways in the 100,000,000 kw.-hr. class. They generated 2,866,100,884 kw.-hr. Adding purchased energy, their total comes to 4,403,351,880 kw.-hr.

Material Loading Cages Save the Time of Line Crews

By M. T. Crawford
Superintendent of Distribution
Puget Sound Power & Light Company, Seattle, Wash.

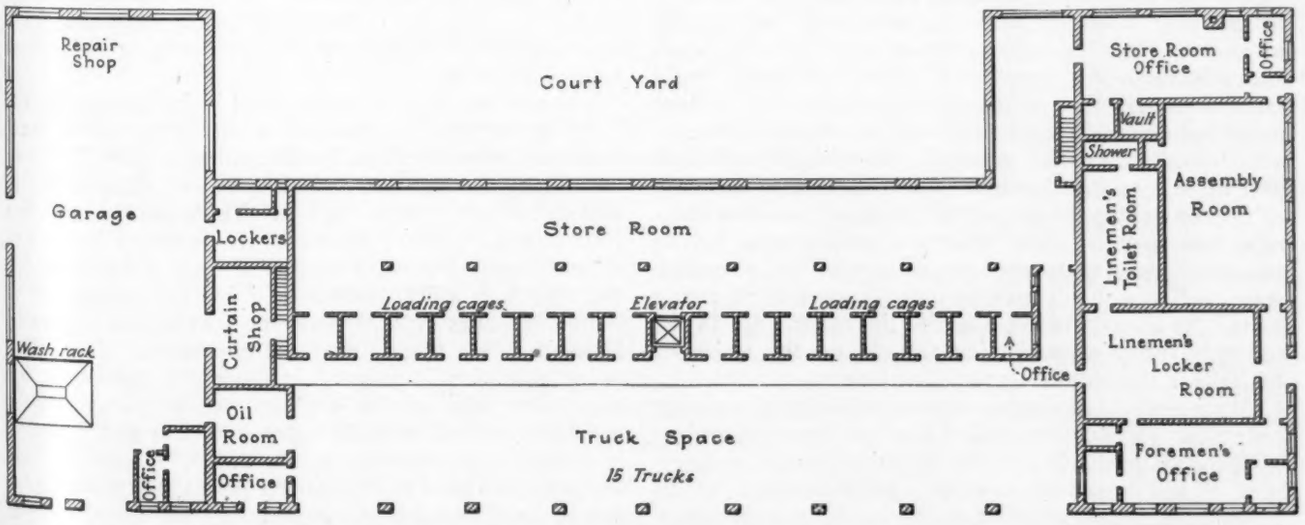
CONSIDERABLE study has been given to improvement of efficiency in the handling of line construction work by the distribution department of the Puget Sound Power & Light Company. One of the recent steps taken along these lines was the construction of a building carefully designed with a view to facilitating the handling of such work.



Inclosed concourse and truck-loading platform with doors opening into material cages

An overhead chain block carrier on I-beam is used for handling transformers and other heavy material.

A reinforced concrete, fireproof building, 115x300 ft., was constructed in Seattle and occupied in 1927 as a headquarters for line construction work within a 30-minute truck-traveling time radius. Under the working rules for employees crews will spend eight hours on the job without payment of overtime under these condi-



Distribution service building floor plan, showing material cages opening into storeroom as well as onto loading platform

tions. The first unit of this building, constructed at this time, is designed to accommodate a total of fifteen overhead and underground construction crews with their trucks. There was also provided a garage and repair shop for trucks and passenger automobiles, stores and office space, locker, washrooms, an assembly room, etc.

Careful thought was given to the arrangement of the building to provide for the routing of materials and equipment from the time they are received until they go out without confusion or loss of time. In the center front of the building, as will be seen from the accompanying floor plan, a concourse was built and provided with roller metal doors in front and a loading platform behind with standing space for fifteen line trucks. Just across the loading platform and immediately opposite each truck's standing space is a small metal cage which opens also into the storeroom.

This somewhat original feature has been found highly efficient in actual practice as it enables the material men in the general foreman's office to order out a complete bill of material on the day previous to the handling of each job. This batch of material can be put into the cage for the proper crew by the storekeeper and locked up. While the truck is in at night the material brought in from one day's job can be taken out and put in the cage and the material for the next day's work loaded on the truck, so that when the foreman arrives with his crew in the morning the truck is loaded and ready to go.

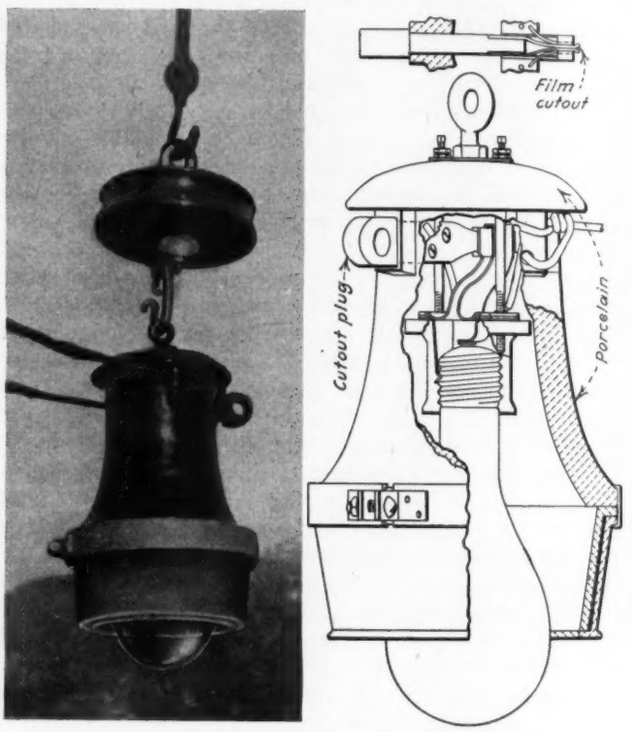
An indication of the economy which has resulted from these improved facilities may be obtained by comparing the actual efficiencies on line construction work during the last six months of 1927, when the new building was in use, with the same period in 1926, when an equally heavy volume of work was handled by the same crews out of headquarters in an old carhouse. This company has for years kept a monthly record of the number of work units completed by line crews from each headquarters. The work unit used consists of such items as a pole set, a transformer hung, etc., selected as nearly as possible to represent an equal amount of labor. While having no exact absolute value, they are very useful for comparative purposes, particularly in checking up on number of men employed and equipment operated in proportion to volume of work done at various times.

During the last six months of 1926 in the old headquarters an average of 47 units per man employed per month was maintained. During the same period in 1927 in the new building, with the improved facilities, an average of 53 work units per man employed per month was recorded. An average of 225 men were employed on line construction at this point, and the 12 per cent improved efficiency indicated from the above record resulted in a substantial saving in the cost of work. A part of this saving, however, was returned to the men, as the company pays a monthly bonus to the crew foremen and material men which is proportional to the record of work units per man employed, and the wage scale itself is also adjusted periodically on a merit rating basis. As a conservative estimate the net savings to the company, after allowing for this, is on the order of $2,250 per month during periods of heavy construction.

Other features of the new service building are a garage and repair shop at one end of the building equipped to handle approximately 150 trucks and passenger automobiles, a full basement accessible from the rear by an inclined driveway across the courtyard, storage space for automobiles and certain infrequently used tools and equipment, a testing and inspection room where distribution transformers are received, tested, repaired and issued. One end of the basement, together with the center part of the main floor, is occupied by the stores division.

A Simplified Street-Hood

FINDING by experience that many radio interferences could be traced directly to loose screw and friction contacts in series street-hoods, the Dallas (Tex.) Power & Light Company took the bull by the horns and designed a hood that apparently will reduce such interferences to the minimum. In the ordinary type of hood there may be as many as twenty or more screw and friction



Porcelain-body street-hood equipped with refractor

contacts, each one a potential broadcasting station. The new hood contains only two contacts that are not solid and permanent—those between socket and lamp base. Also, the new hood has a porcelain cap and body assembly, thus eliminating the iron housing that is so susceptible to rust.

The common type of series hood includes a removable lamp socket that is provided with flat spring contact terminals, between which the film cutout is placed. These terminals push into and separate the two sides of a clip which is in series with the line. There are thus at least four purely friction contacts in the ordinary hood, and in potentiality for radio trouble to these must be added the numerous other contacts held down with screws.

In the Dallas type of hood the film cutout is carried between spring fingers mounted on the end of an insulating plug that is inserted in the hood just below the cap. The sides of the clip into which cutout fingers enter are integral with the contacts of the socket, which is mounted permanently in the hood. A pair of lead wires are soldered to the contact pieces and are brought out of the hood for connection into the series circuit. The design and appearance of the new hood are shown in the accompanying illustrations.

Let Private Enterprise Live!*

Entrance of government into power industry would menace private initiative and endanger the present source of capital

By MATTHEW S. SLOAN
President Brooklyn Edison Company

THE original electric company had a capitalization of a million dollars. The electrical industry today has a capitalization of approximately nine billion dollars. Those figures, thus set in contrast, will perhaps measure for you the growth and development of the industry as clearly and forcefully as anything that could be said about it. Approximately nine billion dollars invested in buildings and lands, machinery and equipment necessary to produce and supply the electrical service for the use of this nation—the service which takes the burden of toil off the back of the housewife and makes homes better places to live in and increases the productivity of the industrial worker and gives him the fattest pay envelope in the world! Add to that, please, the fact that this power and light industry is required to raise about a billion dollars a year of new capital to supply more and better service facilities so that it may not fall behind the needs of the nation. That capital is obtained, because:

First—The business is sound.

Second—The business is growing rapidly, and is progressive and progressing in all its phases.

Third—The business is keenly sensible of its duties as a public servant and responsive to public sentiment regarding its policies and practices.

Fourth—The business is supervised and regulated by public agencies, usually state officials, as to its standards of service, its accounting, its capitalization and the rates it is permitted to charge.

Public utilities are now the largest customers in the money market, and the power and light branch of the utility family requires more new capital than any other. Investors in the securities of the companies are the great insurance companies, savings banks—the Legislature of New York State recently passed a law permitting such investment, making the nineteenth state to do so—colleges and universities, trust funds, and customers of the companies. Since 1914 more than thirteen million shares of stock have been sold by the companies under the customer-ownership plan, providing more than a billion one hundred million dollars of new capital for carrying on the work of these utilities.

The money invested in the electrical industry has been put to good use. It has provided this country with electrical service which is surpassed nowhere in the world. It has supplied the country with the greatest electrical generating capacity for its homes and work-places, which use almost as much energy in a year as all the rest of the world. It has enabled the managements of the utility companies to experiment and to improve their machinery and their technique, scrapping machinery with seeming ruthlessness in the interest of efficiency and economy. building new lines, higher-voltage lines, interconnecting them to make more certain of freedom from interruptions of service and to put the burden of the load on the most efficient generating plants. Thus the capital obtained has enabled the industry to attain lower costs in the face of higher prices it must pay, and as a result there has been, over a period of years, a reduction in the average price of the electricity used by the public.

> *"President Coolidge said not so long ago that once government embarked in business it must become a monopoly in that business. That assuredly is the prospect in this instance. Put government-raised capital into the power and light business, as is now proposed, and you shut private capital out. You serve notice on the electrical industry that it is in competition with the great federal government itself."*

The National Industrial Conference Board reported recently that while the cost of living in July of last year was 62 per cent higher than in 1914, the price of electricity was 13 per cent lower than in 1914. These figures were arrived at after a survey covering 143 cities having a combined population of more than thirty-two million people.

The industry as it is today is the product of American initiative and enterprise—supervised and regulated by public authorities as it should be, controlled by laws and their official administrators as it should be, because it is an industry affected with a public interest, but nevertheless having opportunity, under our American system, to work out its destiny for itself and for the benefit of the public whose servant it is. We of the industry believe the record has been a good one. We are proud of it.

This industry, however, faces new conditions. We deem them a menace to the industry, but, above all beyond that, to the system under which America has grown great. Legislation is pending in Congress which would put the federal government into the electric power and light business. There are two bills for the utilization of the government's war enterprise at Muscle Shoals. They differ materially in their provisions, but the net of both is to seek to embark the government in the manufacture of fertilizer and in the production of power, competing in both lines with the capital of its citizens invested in these businesses. There is also the so-called Boulder Dam bill, termed by its advocates a meas-

* *From a recent address before the Bond Club in Newark.*

ure for flood relief and for conservation, termed by its opponents—and some of them who are fighting it in Congress are no part of the electrical industry—an attempt to put the government into the power business under the guise of a public improvement. Then there are other bills and other proposals not yet brought into the form of legislation which would put the government into the power business in other sections of the country.

The electrical industry has been criticised as selfish (in fact, that is one of the mildest things said about it) because it is opposed to such legislation and such proposals. Perhaps it is. But what is the industry? It is a good deal more than the men who are on the utility payrolls, who happen by virtue of their positions as officers of the utility companies to express that opposition. It includes the investors, individual and institutional, who have put up the nine billion dollars of their savings and now are threatened with government capital in competition. Are these people selfish if they oppose having the government raise funds from them to put to work against their present investments? If they are, it's a trait which will not be found lacking in the very great majority of the people.

There is here no war emergency such as impelled the government to take over the operation of the railroads and go into the shipping business. There is no condition or situation in respect of utilization of Muscle Shoals or prevention of floods on the Colorado which could not be met without putting the government into the electrical business. Why seek to do it, unless there is an intent to change the entire policy of our country respecting government in business?

President Coolidge said not so long ago that once government embarked in business it must become a monopoly in that business. That, assuredly, is the prospect in this instance. Put government-raised capital into the power and light business, as is now proposed, and you shut private capital out. You serve notice on the electrical industry that it is in competition with the great federal government itself. You serve notice on people with money to invest that they will be in competition with government, with its power to tax and to confiscate. Will they do it? Is it good sense to expect that they will be willing to do it?

End of Private Initiative

Creating a government power monopoly, however, would be merely the beginning. Do that, and you notify American business and the American people that the door of opportunity has begun to shut against them. You tell them that one business—a great, vital business, a key industry—has been taken out of the realm of individual opportunity and has been socialized. What will that do to our American spirit? What will it do to American business—not alone that one which happens to be on the firing line now, but to all business?

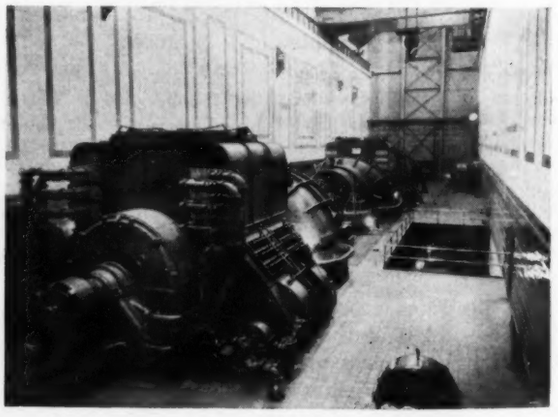
Perhaps I am unable to see this situation entirely clearly, because it is the business to which I have devoted my life which is menaced. It seems to me, however, that no one thing more far reaching in its effects could be brought about. The spirit of man cannot be crushed by obstacles, so long as there remains the opportunity for achievement. But if the opportunity itself be narrowed —if there exists the prospect that it may become still narrower—the inducement to struggle is stifled at birth.

The situation I have been discussing presents something for our consideration far bigger and broader than the future of the electrical industry, important as that may be to our country. There may seem to be in these bills merely a matter of methods and their justification at the moment—a question of expediency. That is the least part of the situation. There is involved in them a vital question of national policy, settlement of which must create a precedent of lasting import. Either this country is to remain what it has been—a land in which business is to be conducted by the people, and the people are to be economically free—or it is to be changed to something else, something not contemplated by the founders of our government. All business is to remain free from government competition and government absorption, or we are to find ourselves on the road to socialization of all business, which means destruction of individual rights, liberty and happiness as we have visioned and experienced them.

Our system of business and government, each operating in its own field, has been proved for nearly a century and a half. It has worked. Business has not been perfect, neither has government, because each can be no better than the people who are engaged in administering its affairs and human nature has not yet reached perfection. Yet the good in government and the good in business have vastly outweighed the bad, and in each field there has been advancement of ideas, advancement of methods and an attainment of results signally beneficial to our people.

The spirit of our nation and the social-economic system in which that spirit finds expression call forth and stimulate the good and discourage its opposite qualities. That, I repeat, our experience has proved. When that spirit is stifled and that system is altered we shall cease to be America, the land of opportunity.

Two 60,000-Kw. Turbo-Generators in New East River Station



STEAM is generated at 375 lb. pressure and 700 deg. F. in six cross-drum boilers in the new East River station of the New York Edison Company. Combustion chambers are entirely inclosed by water-cooled walls of the Murray fin-tube type, no brickwork or refractories being used. It is the first power station to burn pulverized coal on a large scale in New York City.

The air coolers are mounted above the generators and consist of nests of spiral-finned tubes. Each cooler is served by two motor-driven blowers supplying 110,000 cu.ft. of air per minute in a closed system. Cooling water is taken from the condenser circulating system.

Patent Pools and Anti-Trust Laws

By David L. Podell and Benjamin S. Kirsh
Members of the New York City Bar

THE issuance of a large number of inter-related patents and their distribution among various independent owners in the same industry has presented forcibly the necessity of patent co-operation. An inquiry into the legal status of co-operative interchange presents the problem of the extent to which the rights acquired under the patent laws run parallel to or conflict with the liabilities, both civil and criminal, arising from a violation of the anti-trust laws.

In the annual reports of the Attorneys-General of the United States for the years 1924 and 1925 the application of the Sherman law to the acquisition and pooling of patents is noted as one of the major problems of anti-trust enforcement. It "involves the application of the anti-trust law to restraints of trade based upon the acquisition or pooling of competitive patents. The anti-trust law and the patent law have different and to some extent conflicting purposes. Combinations by means of cross-licenses under patents are now frequently encountered." It is to be observed that the Supreme Court in formulating the policy of the law has taken occasion in one important line of cases first to announce one rule of law and then to reverse its former judgment by adopting what had been the dissenting view. This was done, furthermore, over the protest of some of the justices, in whose opinion the law had already acquired the attributes of a rule of property. Of the entire field, it has been stated by an analytical writer that "few problems have given rise to more confusing diversity of judicial opinion."

The industrial and social value of patent interchange and its relation to the anti-trust laws and patent rights are outlined in this article by Messrs. Podell and Kirsh, which appeared in the American Bar Association Journal. A series of patent agreements among gasoline cracking refineries, made as the result of a conflict of patents, recently was held to be reasonable and lawful and was not "in restraint of trade." The whole argument for patent interchange becomes valid only when there is a need for it as in the gasoline case. Where the great majority of patents covering any product are held by one company there may cease to be any need for an interchange of patents covering that product.

Perhaps it is not amiss to point out that the term "pool" is itself unfortunate in view of its inevitable association, in our industrial history, with some of the most oppressive combinations in restraint of trade, which directly led to the formation of our anti-trust policy. For this reason, its use has been avoided, even by stanch advocates of patent interchange. By the "pooling of patents," however, we shall rather refer to the co-operative interchange of patent rights, centralized pursuant to an agreement, including the covenants and restrictions with which one can find them usually accompanied. By means of reciprocal privileges, mutually granted, the licensee gains by agreement what the patent law otherwise prohibits. The meaning of the phrase "restraint of trade," as used in the Sherman act, has been settled since the authoritative definition in the Standard oil case to refer solely to those restrictions which are undue and unreasonable and injurious to the public welfare.

No discussion of the legal questions involved can be thoroughly understood without some knowledge of the value to business and society of the co-operative interchange of patent rights. From the experience of American industry a mass of information lies available to the student of the subject. This is evident by reference to the cross-licensing arrangement in the automobile and aircraft industries and the recent resolution of the National Electrical Manufacturers' Association. One of the underlying reasons for the formation of an interchange of patent rights lies in the practical necessity to adjust infringement litigation where there is a claim of overlapping patents. No royalties, however great, would suffice to pay the tribute which protracted and costly patent litigation exacts. An inflated selling price the commodity ensues. There is a shift, by incidence, of the price of litigation to the consumer. It is, therefore, but prudent and economical business policy to compromise what otherwise would entail enormous expenditures and lead to a diminution of sales.

Fear of infringement suits, injunctions and decrees for heavy damages has dissuaded manufacturers from making expenditures to improve their plants and has resulted in enhancement of prices to secure them against the risk of operation under doubtful patents. Thus it has been said with reference to the cross-licensing agreement in the aircraft industry that it is "a practical business arrangement to do away with litigation over patents and permit the members to build planes rather than try lawsuits against each other. Moreover, a practical consideration arising from our heavily burdened court calendars is that the original trial of a patent suit is not generally reached, in many districts, before two years,

and that before a final adjudication can be reached some four to seven years may elapse, if both parties insist upon exhausting their remedies. Even the payment of royalties under a cross-licensing agreement becomes, therefore, an economically sound business arrangement whereby, in effect, an insurance policy is taken out as security from attack, at a cost known in advance.

Industry Gains the Direct Benefits

From a purely economic viewpoint a mere dedication of reciprocal non-exclusive licenses can be subjected to no reasonable criticism. The industry at large, which is judged by the output of its entire production, gains the direct benefits. There is an increased good will arising from greater confidence in the minds of consumers. Therefore, every product can embody the latest and most aproved engineering ideas and still retain for each manufacturer individuality of design, which is his distinguishing selling feature. The raising of standards follows as a natural consequence. Another important advantage of cross-licensing is in its value to each individual party to the agreement in securing for himself the results of a large volume of development research and the accumulated practical experience embodied in the patents of his cross-licenses. A company putting in five patents may acquire the use of 125 in return, an advantage far outweighing the exploitation of its own inventions.

It has been demonstrated by the recorded experience in the automobile industry that such agreements give an impetus to further invention. Every company is anxious to have the distinction that its product is first to embody the latest improvements in the industry. The automobile industry has found from its experience that for various reasons, such as the skepticism of other members with reference to the value of new patents, the company which secures a patent and applies it immediately to the betterment of its product has at least a year's start over its competitors. A patent owned or controlled by one member of an industry may be useless in itself, yet extremely valuable when combined in use with other patents owned by his competitors. By breaking up what has been aptly termed the "congestion of patents," every patent owner is free to improve his product. Without the privilege of making use of the numerous improvement patents, the patentee finds himself in the position of the owner of a key plot who must pay a stipend to assemble contiguous plottage. Again, the psychological factor in industry is extremely improved when its members can feel that they are united with a single purpose of bettering their product through the common utilization of technical knowledge.

The Anti-Trust Laws and Patent Rights

Regarding the anti-trust laws and patent rights, it is sufficient to indicate that the decided cases apply various legal tests. The chief factors thus far discussed by the courts involve the effect of the combination, its extent, its nature, the methods employed, the intent of the parties and the particular facts in the industry. It is further to be borne in mind that each case arising under the Sherman act must be determined upon a consideration of the particular facts discussed by the record. Justice Brandeis expresses the spirit of the law in the Board of Trade of Chicago against the United States: "But the legality of an agreement or regulation cannot be determined by so simple a test as whether it restrains competition. Every agreement concerning trade, every regulation of trade restrains. . . . The true test of legality is whether the restraint imposed is such as merely regulates and perhaps thereby promotes competition, or whether it is such as may suppress or even destroy competition. . . . The history of the restraint, the evil believed to exist, the reason for adopting the particular remedy, the purpose or end sought to be attained are all relevant facts. This is not because a good intention will save an otherwise objectionable regulation, or the reverse, but because knowledge of intent may help the court to interpret facts and to predict consequences."

Several questions involving the legal consequences of a combination of patentees have not yet been squarely determined by the Supreme Court. One involves the effect of an agreement among various patentees allowing a stated sum, jointly fixed, to be paid as royalties to a patentee for the use of his invention. Another is the effect of arbitration clauses by which compensation for the use of patents is determined by arbitrators as each case arises. There is, however, the recorded authority of the Department of Justice, approving, as not violative of the anti-trust laws, such a clause, found in the Manufacturers' Aircraft Association agreement. The fundamental question of law reduces itself to the proposition that where the purpose and effect of such royalty agreements are merely to secure a fair and just compensation for the use of the patents and are not unduly restrictive of free competition no violation of law occurs. If the royalty charged is small, in comparison with the total cost of the product, there does not seem to be a substantial relation between the royalty and the ultimate selling price. In other words, it is ordinarily too remote in the chain of causation to adjudge that the royalty, which is only a small fraction of the ultimate selling price, is to be deemed a controlling factor in a joint effort on the part of several patentees to regulate the price.

Advantages of Patent Interchange

Viewing its underlying principles, we are led to the conclusion that it is nothing more than a scientific and intelligent co-operation of creative or inventive thought, much akin to a bureau for scientific research. In principle, it is a democratization of ownership or interest in an original or creative idea, or group of ideas, a clearing house for the advancement of invention. Indirectly, it is a dedication to society of the aggregate of such scientific data. Where the patent law would grant exclusive ownership in one, the patent pool extends it to many. That its tendency would be to improve or perfect the product has been confirmed by experience.

Patent interchange tends likewise toward standardization of the product, reduced cost of production, elimination of the enormous waste of litigation and indeed yields; in short, the advantages to the public of a better commodity at a cheaper price. Again we are confronted with the dangers of abuse of concentrated power, either by joint price fixing, boycott against competitors or other illegal restraints, by the combined patentees. There is ample power in the government to cope with such problems as they arise in a given case. That patent co-operation is capable of abuse is doubtless true, but this possibility is inherent in all joint effort. Where it is present it can be detected and penalized in accordance with the provisions of the statutes. A plan which secures to the patentee a just compensation for his novel idea and bestows upon the public the benefits of progress serves a beneficial and commendable purpose. This underlying principle seems to be in harmony rather than in conflict with the anti-trust laws.

"Average Use" Misleading in Analyzing Promotional Rates

THE importance of drawing conclusions from thorough analysis of individual use rather than basing them on application of average figures, when rates of a promotional type are being considered, was emphasized in a recent hearing before the Massachusetts Department of Public Utilities by Vernon Tallman, manager commercial and industrial department, Charles H. Tenney & Company, Boston. He pointed out that the results of making comparisons based on "average use" are not only misleading but far from accurate.

The application of a proposed room rate schedule to the residence service of the Malden Electric Company was under consideration. By this schedule the customer would pay for service under the following rate:

Per Room Per Month	Cents Per Kilowatt-Hour
First 3 kw.-hr.	at 10
Next 5 kw.-hr.	at 7½
Excess over 8 kw.-hr.	at 4

The company claimed that this rate would have reduced the charges to its residential customers more than $68,000 per year. This reduction was based upon a detailed study of a representative cross-section of all the company's accounts and based on actual bill computations.

A calculation of the reduction on the basis of the "average use" customer indicated a reduction of only about $23,000. The error introduced by consideration of the "average use" is, therefore, $45,000 in this particular case, and the reduction under the "average use" basis is only 34 per cent of the true reduction. Companies which have been in the habit of using the "average use" and estimating reductions based upon it may find that their actual reductions are three times as much if they analyze the bills in detail. This is a pitfall to be carefully guarded against, as is well recognized by experienced rate engineers.

By way of illustration, Mr. Tallman presented a comparison of the two methods of calculation in a simple case of five customers having six rooms each:

Customers	Total Kw.-Hr.
Four used 20 kw.-hr. per month each, or	80
One used 70 kw.-hr. per month, or	70
Total used by five customers	150
Average per customer	30

Bill for average customer calculated on old and new rates:

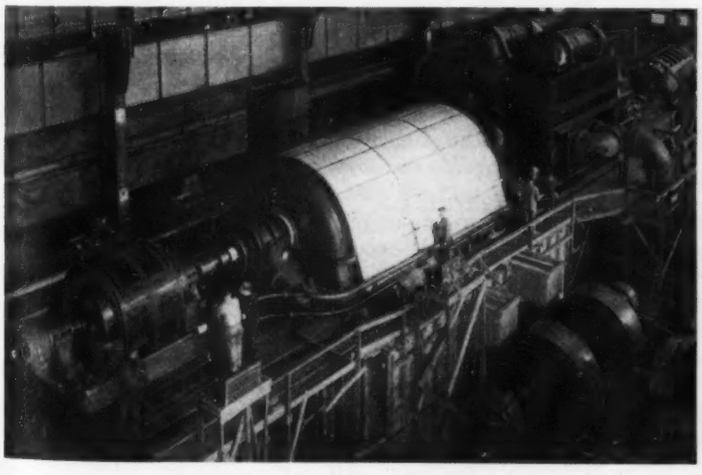
Old Rate	
15 kw.-hr. at 10½ cents =	$1.57
15 kw.-hr. at 8 cents =	1.20
30 kw.-hr.	$2.77
New Rate	
First 3 per room 18 kw.-hr. at 10 cents =	$1.80
Next 5 per room 12 kw.-hr. at 7½ cents =	0.90
30 kw.-hr.	$2.70

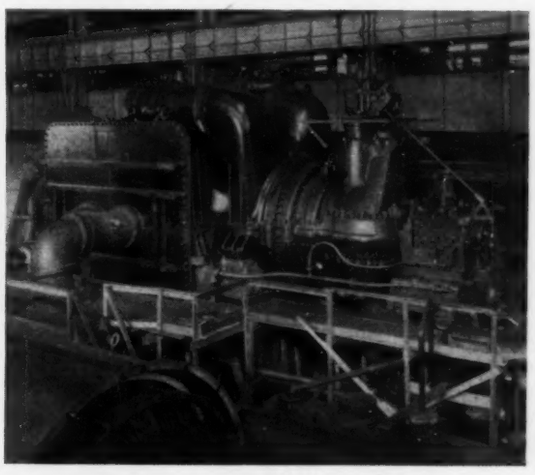
A saving of 7 cents per month per customer or 35 cents per month for the group.

Bills for actual customers calculated on old and new rates:

Old Rate			
15 kw.-hr. at 10½ cents =		$1.57	
5 kw.-hr. at 8 cents =		0.40	
20 kw.-hr.			
Four customers at		$1.97 or	$7.88
New Rate			
18 kw.-hr. at 10 cents =		$1.80	
2 kw.-hr. at 7½ cents =		0.15	
20 kw.-hr.			
Four customers at		$1.95 or	$7.80
15 kw.-hr. at 10½ cents =		$1.57	
55 kw.-hr. at 8 cents =		4.40	
70 kw.-hr.			
One customer at		$5.97	$5.97
Total for group			$13.85
Average rate		9.2 cents per kilowatt-hour	
First 3 per room	18 kw.-hr. at 10 cents =	$1.80	
Next 5 per room	30 kw.-hr. at 7½ cents =	2.25	
Excess	22 kw.-hr. at 4 cents =	0.88	
	70 kw.-hr.		
One customer at		$4.93	$4.93
Total for group			$12.73
Average rate		8.5 cents per kilowatt-hour	

90,000-Kw. Generator Shipped Completely Wound





THE new turbo-generator unit of 90,000 kw. capacity designed for the Long Beach plant of the Southern California Edison Company is unusual because of its high rating and for the use of a terminal voltage of 16,500. The turbine is a single-shaft, tandem-compound unit. The high-pressure cylinder contains an eighteen-stage rotor and the low-pressure cylinder a three-stage double-flow rotor. Steam is used at 400 lb. gage and 725 deg. F. total temperature.

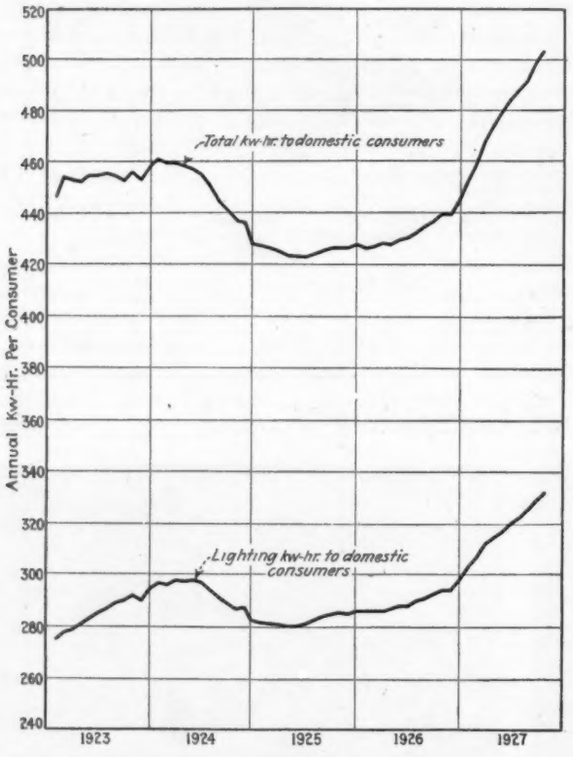
The generator was shipped completely wound, an accomplishment made possible by the welded construction of the unit. It is the product of the General Electric Company and is shown in the process of shop testing.

1,331 Ranges Sold in Seven Weeks' Campaign

Southern California Edison Company has most successful campaign in its history. Dealer co-operation and old-range allowance were factors

By R. G. Kenyon
Assistant Advertising Manager Southern California Edison Company, Los Angeles, Calif.

MERCHANDISING accomplishments of the Southern California Edison Company for 1927 under the supervision of W. L. Frost, general commercial manager, culminated in the most successful major appliance campaign of the company's history—a seven weeks' Hotpoint range campaign. The actual ranges sold, 1,331, were more than double the quota of 600 ranges set for the entire system. Of the ranges sold, 1,003 were sold by the Edison company merchandising organization; the balance, or 328 ranges, were sold through electrical contractors or dealers. Every dealer and contractor in the territory was invited to take advantage of the public desire to buy ranges which would be



Kilowatt-hour sales to domestic customers show effect of increased sales activities

created by the intensive campaign carried on by the power company. The record of 328 ranges sold through dealers and contractors amply proves that the contractor-dealer is a very valuable potential outlet for electrical merchandise when the proper co-operative help is given.

In this campaign ideas found profitable in previous range campaigns were adopted. Special terms of $10 down and the balance in six, twelve or eighteen months were offered. Three modes of advertising were used —window trims, newspapers and direct mail. Window-trim material was furnished all district offices and suggestions and helps for the proper use of this material were offered them. In the newspaper campaign every one of the 160 newspapers in the territory served by the company carried at least one ad every two weeks and in the larger papers one ad a week. In addition to carrying the name of the Southern California Edison Company in all cases, the dealer's name in the local district was included in the advertisement. In the direct-mail advertising a selected list of 40,000 names was circularized with a four-piece mailing campaign. The three first pieces consisted of combination broadsides and letters. The fourth piece was a return government postcard to impress upon the prospect the necessity of immediate action to benefit by the campaign. All mailings carried with them return postcards asking for information.

In the advertising copy stress was placed upon the fact that range users enjoyed a very low rate for all electricity used. In addition each piece of advertising matter carried a line telling the reader that his own electrical dealer was in position to offer the same terms of sale as the power company.

To stimulate interest in the campaign on the part of employees bonuses were offered by the company. All employees turning in prospects which developed into sales were paid a bonus of $2.50 for each prospect. In addition to this company-paid bonus, many of the salesmen added a like amount on their own account. As a consequence 374 sales were directly traceable to employee leads.

Old Range Allowance

Departing radically from all previous sales policies, a salvage allowance was offered on consumers' old cooking equipment. Salesmen were empowered to take in trade the old range of the prospect, irrespective of make or condition, for a sum not to exceed 10 per cent of the purchase price of the new range. About 50 per cent of all sales made by the Edison sales organization were made with this trade-in allowance, a total of 484 sales out of 1,003 being thus made. In addition to this salvage allowance each Hotpoint range carried with it a premium of an Edison waffle iron and tray. To establish the real value of the waffle iron and tray it was offered as a small appliance special during the period of the campaign, at a special low price. To carry the message of this special to consumers, 240,000 stuffers were sent out with the monthly bills during the campaign. These stuffers emphasized the waffle iron special, but also carried the story that this waffle iron was obtainable free with a Hotpoint range. The dealers were privileged to make the same trade-in offer on ranges which they sold, except that they were not empowered to give away a waffle iron with ranges other than Hotpoint. The Edison company refunded to the dealer the amount allowed on the old range and also furnished the waffle irons in the case of Hotpoint range sales.

In presenting campaign plans to the Edison sales organization a series of meetings was held throughout the territory. These meetings were addressed by R. W. Turnbull, Pacific Coast sales manager of the Edison Electric Appliance Company; P. H. Booth, southern California representative of the same company; H. C. Rice, merchandising manager of the Southern California Edison Company, and R. G. Kenyon, assistant advertising manager of the same organization. Much of the outstanding success of the campaign has been attributed to the sales talks made by Mr. Turnbull at these meetings.

Since the Southern California Edison Company is primarily interested in increasing the consumption of existing customers, the results shown by the accompanying curves indicate that range campaigns such as this have had a most decided effect in accomplishing desired results. Evidences of the value of the additional sales effort put upon ranges and appliances is brought out by these curves. Both curves cover a period beginning with the first of 1923 and running through to the end of 1927. In the lower curve lighting sales to domestic customers are shown. The upper curve shows total sales to domestic customers. In this compilation all domestic consumption is covered, including lighting, cooking and water heating. It will be seen that from the low ebb of 422 kw.-hr. per customer in 1925 the company has rapidly built up the per customer consumption until it has reached the high figure of 502 at the end of October, 1927. Both curves are built up on the basis of kilowatt-hours per customer for twelve months ending each month.

Electric Forging of Tappets Proves Successful

By Sam Stites

Power Engineer Consumers Power Company, Battle Creek, Mich.

AN INTERESTING application of electric heat has lately been made at the plant of the Rich Steel products Company in connection with the manufacture of tappets for automobile valves. These are usually made from $\frac{5}{8}$-in. steel stock formed in an upsetting press. The stock is first cut into 5-in. lengths and partly machined. In the next operation about 2 in. of one end is brought to a red heat and the piece placed in a die. The die is placed in a press and the projecting red-hot end is upset. On the return stroke of the press the die is reversed by the operator and the piece is pressed out by a plunger. Heating prior to upsetting is done by a Berwick heater, made by the American Car & Foundry Company, with slight modifications to adapt it to the tappet job.

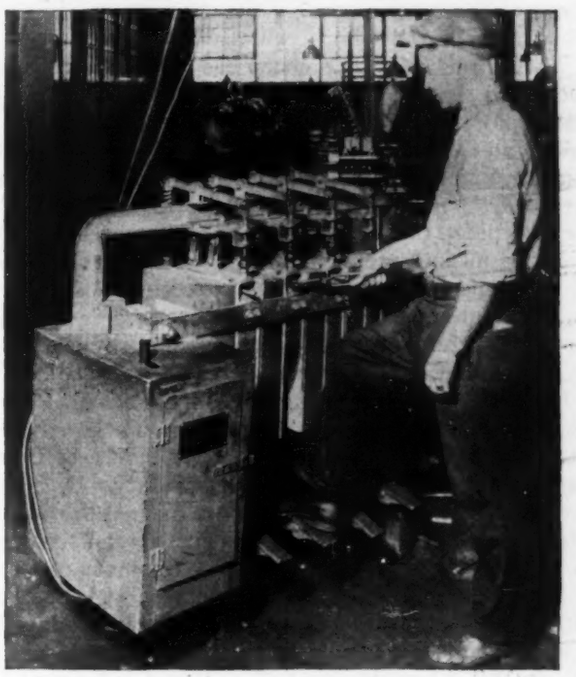
In service, the piece to be heated is held in tongs by the operator and inserted between two copper jaws forming one electrode. The second electrode is a solid block of copper pressed by a spring against the end of the stock. A transformer integral with the heater supplies the necessary current. The tappets as turned out by the press are formed to such close limits that little machining is required, and for this reason the stock must not be marred or pitted in heating. When the electric heater was first tried some difficulty arose from imperfect contact, causing burned or pitted spots at the points of contact between the stock and the electrode. This was overcome by slightly rounding the jaws at the contact point and increasing the spring pressure.

The results were such that two more heaters have been ordered, making four in service. Better quality of work has been obtained and the company finds the method more economical than former methods. These units give the power company a load with an annual consumption of 140,000 kw.-hr. and a revenue of about $2,500. Two test runs gave the data shown in the accompanying table.

EXPERIENCE WITH TAPPET HEATER

Diameter of stock	¼ in.	
Length of part heated	2 in.	
Weight of metal heated	0.174 lb. per piece	
Demand of heater	15.8 kw. maximum	
Power factor of above demand	96 per cent	
	Test No. 1	Test No. 2
Time, hours (week's production)	3	1
Number of pieces heated	1,054	13,642
Kilowatt-hours used	40	550
Kilowatt-hours per 100 lb.	20.6	23.2
Kilowatt-hours per 1,000 pieces	37.9	40.3
Cost, electricity per thousand pieces (at average annual rate)	$0.70	$0.75

Note—Test 2 gave lower efficiency as operator left heat on during mechanical adjustment of press.



Heating tappets electrically cost 70 to 75 cents or less per thousand pieces for energy

Changing-Color Floodlighting for Philadelphia

THE color lighting of the exterior of buildings may soon prove to possess valuable possibilities for increasing commercial revenues. An attractive and spectacular development in floodlighting has been incorporated in the exterior illumination of the new home of the Philadelphia Electric Company. Changing colors are projected onto the stepped-back superstructure, upper walls and columns of the new Edison Building. The equipment used for this purpose is mounted close to the surfaces to be illuminated and the lamps are provided with color caps similar to those planned, but never used, for the Tower of Light at the Sesqui-Centennial in Philadelphia. There are 483 floodlights utilizing 500- and 1,000-watt lamps in this installation. The necessary apparatus was supplied and designed by the Pittsburgh Reflector Company, the Ward Leonard Company and the Laco-Phillips Company.

Several years ago illuminating engineers of the Commonwealth Edison Company co-operated with the owners of the McJunkin Building, Chicago, in providing for that structure exterior color illumination. Instead of utilizing wash color, use was made of harmonizing combinations of color to produce artistic effects.

Letters from Our Readers

Stokers for New Detroit Plant No Reflection on Powdered Fuel

To the Editor of the ELECTRICAL WORLD:

The Detroit Edison Company has just decided to install underfeed stokers for the first six boiler units of its new plant, now in course of construction, which is to be known as Delray power house No. 3. Inasmuch as this company's Trenton Channel plant, which immediately preceded this in construction, is equipped for pulverized fuel burning, the choice of stokers for Delray No. 3 might be misinterpreted as indicating that in the opinion of the company's engineers the stoker method of firing had inherent advantages over the pulverized fuel method. Any such inference would be misleading in the extreme, as other factors must be considered.

It is pertinent to explain that until Trenton Channel was built it had been the Detroit Edison Company's long-established practice in all of its power plants, at Delray, Connors Creek and most recently at Marysville, to employ an underfeed type of stoker well suited to the character of the best coal ordinarily available; a comparatively low-fusing, very high volatile bituminous coal from West Virginia and eastern Kentucky. Long experience with stokers had developed the company's stoker practice to a satisfactorily high standard at the time the Trenton Channel plant was designed. The use of pulverized fuel at Trenton was therefore a new departure in the company's practice. The factor which conclusively determined that departure was the belief, later amply borne out by the result, that with pulverized fuel the plant would very easily adapt itself to minor variations in character of coal without impairment of capacity and with a minimum impairment of efficiency. It was felt highly desirable to have at least one such plant in the system in order to facilitate classifying the incoming coal and if it should ever become necessary to permit favoring the older plants at Delray and Connors Creek in the allocation of the received fuel. The southern site at Trenton Channel and its large trackage for receipt of coal made it particularly suitable as the pulverized coal plant in this set-up. Its projected large share in total output (41 per cent in 1927) would necessarily make it an important factor in the problem of fuel supply.

Trenton Channel, with the last of its complement of six 50,000-kw. turbines now being erected, has justified the decision made at the time its design was fixed. The investment per kilowatt installed is moderate and its operating performance has never fallen below the estimate of efficiency. For more than a year and a half it has consistently bettered that estimate, and there is reasonable expectation of further improvement. Problems incidental to the method of fuel burning have been satisfactorily met; for instance, the problem of substantial reduction of the fine ash carried away by the furnace gases. The Cottrell precipitators, with which all the boilers are now equipped, seem to be entirely practicable pieces of power plant equipment and are catching large quantities of dust, which for the time being is sluiced on to nearby marshy ground.

At Delray the new plant will be handled by the same organization that has superintendence of the two older power houses, Nos. 1 and 2. The management of stokers for high efficiency will be no novelty for that group of men. Estimates of performance and of required investment for the two types of plant (stoker and pulverized fuel) indicate total costs for the Delray location so nearly alike as to suggest the question whether or not the difference is of the same order as the possible errors of estimate. The final decision to install stokers in the first section of plant was determined by a consideration ordinarily too insignificant to become a controlling factor in plant design.

Up to the present time no permanently satisfactory way has been found for disposing of the fine ash produced by pulverized fuel furnaces after it has been caught. At Trenton Channel there are still marshes to be filled in, but there are no longer any such hollows near Delray. Conversely, the sale of stoker cinders from the Delray plant in a local market which it has never been possible to satisfy will earn a credit of something more than 6½ cents per ton of coal burned. These well-burned cinders are used as aggregate for concrete roof and floor slabs, as the body of so-called cinder blocks used in building construction, and in other ways which constitute a demand for cinders all the year around. But nobody wants the fine residuum from pulverized coal fires.

The design of the new Delray boiler furnaces can be easily adapted to pulverized fuel and the plant would accommodate the necessary equipment, but until this particular commercial problem of ash dust disposal is solved the Detroit Edison Company prefers, and will continue the use of, stokers at the Delray plants.

J. W. PARKER,
Vice-President and Chief Engineer.

Detroit Edison Company.

Agrees as to the Undesirability of Steaming Timber

To the Editor of the ELECTRICAL WORLD:

I have been much interested in the articles and discussions on the treatment of Southern pine poles and particularly in the discussion of Mr. Wilson in your edition of April 14. I agree thoroughly with him in his opinion as to the undesirability of steaming timber. If the temperature is raised too high the strength of the timber is permanently impaired. If fairly high temperature is not used the so-called steam seasoning is inefficient. Committee 17 of the American Railway Engineering Association, when it offered the new specifications to that association, made no provision for steaming timber and expressed the firm opinion that this method of treatment should not be used except in emergency. As a member of this committee I concurred heartily.

Air seasoning can be successfully practiced in almost any location on the Atlantic and Gulf Coasts if proper care is taken. There has been much timber damaged in this process, but the damage is generally caused by improper methods. An air-seasoned stick can be much more evenly treated. It has greater strength and in every way makes a more desirable pole than a steamed pole. The cost of carrying poles for the required time is not excessive, amounting to not over 10 or 15 cents for a 35-ft. B pole, and this added cost is certainly justified by the greater value of the pole when so treated.

Some other preservatives are coming into use, but they cannot be used except with air-seasoned timber. One of these seems to have great value for pole treatment.

WILLIAM G. ATWOOD,
Consulting Engineer.

New York.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Waterwheel Testing and Operating Records of Plant Discharge. — This serial report of the hydraulic power committee of the N.E.L.A. includes recommendations for the study and use of modern facilities for the measurement of hydro-electric power plant water input and available power. Conditions reported for the industry include: Definite improvements in plant earning capacity; stand-by losses that are often unknown and can be prevented; operating experiences, including methods and apparatus; special use of well-known metering principles, and the practice of including in plant design advance preparation for tests and metering work. The balance sheet idea as applied to power plant operation is explained in detail in connection with the activities of one of the largest of the hydro-electric systems, as is a description of a long-distance recording water level gage utilizing the Selsyn motor principle.—*Serial Report National Electric Light Association,* March, 1928.

Propeller Turbines as Hydro-Electric Prime Mover.—H. PFLIEGER-HAERTEL. —The utilization of low or medium head water power with Francis type waterwheels leads to low speeds and consequently large generators. The introduction of the propeller turbine was a marked improvement in this respect, since this construction may, according to the author, readily give a specific speed of up to 1,000, or more than twice the value of the Francis turbine. Equipped with three to six vanes, the chief characteristic of the propeller wheel is an open space between vanes, which may be as much as 50 per cent of the vane surface. A special hub construction permits a change of the angle of the vanes to regulate speed or efficiency. During 1927 a total of 100 propeller turbines were installed in Europe.—*Elektrotechnische Zeitschrift,* March 22 and 29, 1928.

Units, Measurements and Instruments

An Instrument for Measuring Very Small Displacements.—JUICHI OBATA. —The construction and application of a new instrument for measuring small displacements or motions and utilizing an electrical circuit are described by the author. In its usual form the instrument consists of a tuned grid circuit, but it is stated by the author that this can easily be changed to the Colpitts-Hartley circuit. The displacement or motion to be measured is made to produce either a change in the capacity of the circuit or a change in the eddy-current loss, and in consequence a corresponding change in the anode current of the thermionic valve. This change in the anode current is measured with a galvanometer, or, if a permanent record is required, an oscillograph may be used. In this instrument the capacity method, as well as the eddy-current method, may be utilized, and the anode current may be balanced or a transformer may be inserted, all the necessary resistances and the transformer constituting a unit.—*Journal of the Institute of Electrical Engineers of Japan,* January, 1928.

Limits of X-Ray Investigations.— O. MORGENSTERN.—To find blowholes or detect a lack of homogeneity in metal castings, porcelain and other solid materials a visual investigation or a photographic record witn X-rays is used extensively. The author points out that, beyond a certain thickness of the materials tested, the output of the X-ray tube, the necessary time of exposure and the clearness of the resulting negative are three factors which set a definite upper limit to the usefulness of this process. Tubes of the Coolidge type are available today for 500 watts, 1,400 watts and 5,000 watts input, while tube voltages of as high as 230 kv. can be managed. Aluminum or aluminum alloy castings up to about 12 in. thickness and iron or steel up to 4 in. represent today, and probably for many years to come, the upper limit. A 10 per cent increase in thickness requires for iron and 220-kv. tube voltage a trebling of the exposure. — *Siemens Zeitschrift,* February, 1928.

The Design of Nomograms.—L. B. W. JOLLEY.—The discussion in this article is restricted to a description of one type of diagram, but the elements of design have been thoroughly considered, offering an analysis of the determination on which the whole subject of nomograms rests. The author has analyzed the determinants, has applied the determinants to alignment charts with straight, parallel and curved scales and presents the necessary mathematical considerations. The alignment chart is not claimed as being an ideal method for the presentation of facts for analysis as it is of little use for that purpose, but it is suggested for quick calculation of data from complicated formulas and is seen as possessing manifest advantages over the more conventional methods. — *World Power,* April, 1928.

Study of the Operation of the Multivibrator. — YASUKAZU NAMBA and SHOGO NAMBA.—The multivibrator used for the purposes of frequency standardization and incorporating the valve-maintained tuning fork is considered by the authors. This discussion illustrates the experimental results obtained in the study of frequency and wave forms and discusses the findings with respect to both the analytical theory and experiments. The results of the experimental and analytical determination check very closely and are completely illustrated.—*No. 218, Researches of the Electrotechnical Laboratory (Japan).*

Motors and Control

Clutch Pulley for Induction Motors. —J. BETHENOD.—To diminish the starting current of an induction motor with short-circuited armature various types of clutch pulleys have been introduced in late years, most of them based upon a centrifugal operating principle. The pulley described in this article, contrary to former designs, is exceedingly simple, having no springs or internal bearings. The construction consists of an inner pulley, keyed to the motor shaft, and a concentric outer pulley, loosely turning around the former. Between these two are arranged twenty identical punched U-shaped metal pieces, which can rock over ribs cast into the two pulleys. When the motor assumes speed, these pieces begin to press against the inner periphery of the pulleys, causing such an amount of friction as to take the outer pulley along gradually. Holes are provided in the sides to admit a current of cooling air.—*Revue Générale de l'Electricité,* March 24, 1928.

Electrical Drives in Rubber Factories. —The power requirements and motor specifications in connection with the various processes in rubber manufacture have been outlined in relation to several specific installations. Safety devices, including a free-fall safety brake and similar items of protective equipment, are considered. The most important feature of this safety brake lies in the fact that the weight falls absolutely freely until impact occurs between the brakeshoe and the brake disks. As soon as the brakeshoe is applied the weight is released through special mechanism in such a way that the energy stored up in it is applied without shock to the brakeshoe. Consequently, the rapid application of the braking force insures that the required bodies are brought to rest in the shortest time and without vibration.—*Brown Boveri Review (Switzerland),* April 1928.

Heat Applications and Material Handling

Annealing of Non-ferrous Metals in the Electric Furnace. — ROBERT M. KEENEY.—Selection of the source of heat for the annealing of non-ferrous metals and alloys is an economic problem, according to the author, and the decision should be based on the overall cost of the finished product with the different forms of heat. For annealing in finished stages electric furnaces are said to have proved more economical than oil or gas, in many cases resulting in an annual return of 50 per cent on

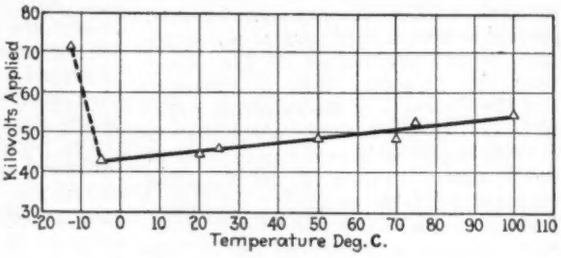
the investment. In the rolling mill, however, little progress has been made, although the cost of electric annealing, on a heat basis only, compares favorably with the cost of oil annealing. This situation is due to failure to consider economies in over-all cost which electric annealing may produce, the basis on which electric heating has made such great progress for tonnage production in the motor industry.—*Report American Electrochemical Society,* April, 1928.

Condensers for Welding Machines.—I. C. FRITZ.—Various attempts have been made in the past to overcome the very low power factor of arc-welding and resistance-welding machines. Arc-welding sets with an induction motor and direct-current generator operate usually with 0.4 to 0.8 power factor and an efficiency of 50 per cent, while single-phase arc-welding transformers produce as low as 0.1 power factor load. It is suggested here that by connecting a small condenser across the primary of the welding transformer the power factor can be restored to unity. If a compensation to 0.8 is satisfactory the condenser will be found to weigh about one-half of the transformer weight, to require about three-quarters of its space, and its cost is one-third that of the transformer. A welding outfit for 14 kva., requiring previously special connection to a power line, can be connected to the light supply when equipped with a compensating condenser, since it will call for only 4 kva. actual power consumption. — *Elektrotechnische Zeitschrift,* March 8, 1928.

Electrophysics, Electrochemistry and Batteries

The Effect of Curved Boundaries on the Distribution of Electrical Stress Around Conductors.—J. D. COCKCROFT.—An investigation, by the method of conformal transformation, of the distribution of electrical stress around certain systems of conductors which are important in high-tension practice. The effect of rounding the edges of the conductors in reducing the high stresses at the edges has been determined quantitatively and particular attention has been devoted to this phase of the subject. The methods used are applied to calculate the variation of the breakdown voltage with spacing distance between the electrodes. The two-thirds power law is derived as a limiting case for some of the electrodes and the effect of variation of electrode shape and of physical assumptions is shown. The theoretical results are compared with such experimental data as are available. Approximate formulas are derived, for the capacity of coaxial rectangular cylinders, which are an extension of the well-known correction for the corner of a Leyden jar, and their application to heat-conduction problems is pointed out. The results are reduced to graphical form.—*Journal of the Institution of Electrical Engineers (England),* April, 1928.

Liquids as Insulators. — FRANK M. CLARK. — A general consideration of liquid dielectrics has been undertaken by the author. These are said to bear a strong resemblance to gaseous dielectrics whose characteristics were described in a previous article in the same publication. The chemical, physical and electrical properties of the ideal liquid dielectric are outlined, as are those of the materials at present available. Temperature effects are considered to offer a major factor in the alteration of the properties of such insulating media and the author has included a consideration of the influence of catalysts upon the oxidation process as well as a review of the methods for detection and measurement of oil sludging characteristics.



Dielectric strength of mineral oil varies with temperature

Other properties are likewise reviewed in considerable detail in connection with the test results and investigating procedure. — *General Electric Review,* April, 1928.

Effect of Temperature and Other Factors on the Performance of Storage Batteries. — G. W. VINAL and C. L. SNYDER.—Experiments are described in this paper in which the effect of extreme conditions, such as low temperatures and high discharge rates, are determined separately for positive and negative plates of a lead storage battery. It was found that the temperature effects are less for the higher concentrations of the electrolyte in the case of positives, whereas the reverse is true for the negatives. Under extreme conditions, such as in airplane service, the negative plates are likely to become the limiting factor in determining the capacity. The best concentration of electrolyte for use in batteries under extreme conditions is a compromise between the requirements of the positive and negative plates. The change in capacity with temperature, when the capacity is limited by the positives, is inversely proportional to the changes in viscosity of the solution. The conditions under which localized freezing is liable to occur are indicated. The possible effect of these various factors upon the operation of airplane batteries is another phase of the subject which is discussed. — *Report American Electrochemical Society,* April, 1928.

Telegraphy, Telephony, Radio and Signals

The Principles of Relay Timing in Connection with Automatic Telephone Circuits.—T. H. TURNEY.—The author has developed the theoretical considerations involved in the relay timing of automatic telephone circuits. The relay is first considered as a simple coil which leads logically to Helmholtz's law. The inclusion of a slug, ignoring flux leakage, increases the time constant of the relay. As the rise of flux no longer obeys Helmholtz's law when flux leakage is present a rough treatment giving two exponential terms is utilized in place of one. In order to examine the effect of flux leakage a little more thoroughly the relay core has been viewed as a transmission line. The slug becomes distributed inductance, and the resulting telegraph equations have been solved by Heaviside's expansion theorem. In no case is the actual motion of the armature considered in this paper. —*Journal of the Institution of Electrical Engineers (England),* April, 1928.

Miscellaneous

A Method of Analyzing the Performance Curves of Centrifugal Pumps. —JOSEPH LICHTENSTEIN.—Development of analytical and graphical methods for determining correction factors from test curves for use in bringing theoretical pump equations into harmony with practice are given in this discussion. It is stated by the author that centrifugal pump practice still bases its calculations on the one-dimensional theory which assumes a frictionless fluid flowing through an impeller with an infinite number of blades. It is evident, according to the author, that the results of this theory cannot well conform with actual practice where the number of blades is small and where friction and a turbulent flow of water are encountered. Attempts to introduce a theory better adapted to the actual pump design have been made. These theories are not utilized by the pump designer because they are more complicated and not so general as the classical theory, being based on certain profiles which would limit the engineer in his designs, but especially because they are also based on a frictionless non-turbulent flow, a supposition far from reality. The present discussion is therefore based upon empirical factors rather than upon theoretical ones. Certain assumptions have been made upon which the various factors are developed. The discrepancy between the theoretical results and the classical one-dimensional theory used in calculating centrifugal pumps and the actual practices introduces correction factors that can only be deduced from tests. Correction factors have been introduced in the equations of the classical one-dimensional theory and new equations have been developed which can be used for calculating new pumps.—*Transactions American Society of Mechanical Engineers,* January-April, 1928.

News of the Industry

Maryland Commission Again Refuses to Sanction Sale

The Maryland Public Service Commission on April 26 dismissed for the second time the application of the Electric Public Utilities Company of Chicago for permission to purchase for $518,000 the Home Electric Light Company of Lonaconing, the Emmitsburg Electric Company, the Antietam Electric Light & Power Company and the Midland Electric Light Company, all in western Maryland. During the rehearing the commission was informed by its engineers that the reproduction costs of the properties of the utilities would be approximately $315,000, less depreciation.

No detailed criticism of the proposed transaction was given out last week by the commission, which simply said that it "would be detrimental to the public interest." Last year when it disapproved the transaction the commission gave as its reason that it could not "see wherein the public will be benefited in the slightest degree." An appeal was taken to the Circuit Court of Baltimore, which upheld the commission. Then the case was taken to the Court of Appeals, which found this negative reason insufficient and sent the case back to the commission (ELECTRICAL WORLD, March 10, page 528).

Considerable interest has been aroused in public utility circles and among state commissioners by this case because of its bearing on the proper commission attitude toward the proposed acquisition of independent properties at inflated prices.

International Rules for Tests of Hydraulic Machinery

At the instance of the World Power Conference the International Electrotechnical Commission undertook at its meeting in Bellagio last year to elaborate suggestions for an international agreement regarding the regulations to govern water-power plants. The rules agreed upon in sectional conference were referred to the national committees of Germany and Sweden, to which had been granted the right to appeal before Jan. 31, after which the rules were to be proposed as international regulations.

A German hydraulics committee was formed, with the permission of the German National Committee, to study these questions, and this committee has recommended acceptance of the Bellagio agreement as containing general rules in outline, inside of which each country would be free to compile its own rules according to the local requirements. The committee is now revising the German rules, which may then serve as a basis for additional international agreements.

Above all, the question of the measurement of water volume is receiving undivided attention, and all available experience and comparative results, as well as tests now being made in German and foreign hydraulic laboratories, will be turned to account. The book of rules is to be supplemented by an appendix containing the principal terms in several languages, and formulas and values will be published in both the metric and English systems of weights and measures.

Federal Trade Commission Digs Diligently

Unearths Payments by Joint Committee to Former Governors of New Mexico and Nevada, but Bulk of Testimony Adduced Lacks Interest

OPEN sessions of the investigation of public utility companies ordered by the Senate continue to be held in Washington by the Federal Trade Commission and to elicit testimony varying from details of the purest routine to making public financial transactions which have been seized upon as ammunition by the newspapers and politicians eager to score points against the industry.

The most fruitful of the latter, from the point of view of opponents of privately owned utilities, was brought to light on Wednesday of last week, when a total of $5,299 was shown to have been paid to the law firm of Meechem & Vellacott of Albuquerque, N. M. This amount, according to Ira L. Grimshaw, assistant director of the Joint Committee of National Utility Associations, was for the firm's services in reporting the conferences of Western governors called in 1927 to endeavor to settle state disputes over Colorado River development. Judge Healy, the Federal Trade Commission's counsel, pointed out that Mr. Meechem, formerly Governor of New Mexico, had been appointed by Governor Dillon of that state to represent it at the conference. Mr. Grimshaw implied ignorance on his own part of that fact, and Mr. Meechem subsequently said to newspaper men in the West that there had been no desire or attempt to conceal his employment by the joint committee.

On the following day Judge Stephen B. Davis, director of the joint committee, was asked about $600 paid to former Governor James G. Scrugham of Nevada for expenses of two trips East. Judge Davis said these trips were financed at Mr. Scrugham's own suggestion and that the latter was working with the committee to reconcile diverse opinion on the Colorado problem. Mr. Scrugham was a member of Secretary of the Interior Work's fact-finding commission on Boulder Dam.

DISTRIBUTION OF LITERATURE

Since its organization in June, 1927, the joint committee, testimony showed, had distributed nearly two million pieces of publicity and had paid $55,000 for salaries, $30,000 for booklets and other literature, $31,000 for special publicity services and $37,000 for its Washington office. No expenditures had been made to public men for articles or for the use of their name except the $7,500 paid, as reported last week, to Richard W. Child, former Ambassador to Italy, for his work on a Boulder Dam booklet edited by Frank Bohn. No money had been paid directly or indirectly to schools.

Edward S. Mansfield, in charge of educational activities in New England for the National Electric Light Association, told of a survey on co-operation between utilities and educational institutions being made under N.E.L.A. auspices by Dean C. O. Ruggles of Ohio State University.

Josiah T. Newcomb, counsel for the joint committee, testified that he did not feel the committee had been organized to oppose government ownership, though the members were against it. He agreed that the committee's principal function and his own were to represent the utility companies in all matters of pending legislation before Congress. He referred to an interview in which Senator Walsh of Montana was represented as saying that the utilities and their controllers had "taken two billion dollars from the circumambient atmosphere" and had issued securities with no assets behind them. The committee desired to dissipate such misinformation. Mr. Newcomb admitted the interest taken by his committee in tax revision, federal regulation of interstate transmission of energy, government operation of the Muscle Shoals plants, flood-control legislation, the Boulder Dam project and similar matters of legislation.

N.E.L.A. WITNESSES

Paul S. Clapp, managing director of the N.E.L.A., and George F. Oxley, in charge of publicity, appeared before the commission on Friday and explained the advertising and other policies of the association. Mr. Clapp declared himself opposed to political propaganda.

When the commission resumed its

hearings on Wednesday, May 2, Clarence G. Willard of New Haven, secretary of the Connecticut Committee on Public Service Information, and A. Bliss McCrum, secretary of the Public Utilities Association of West Virginia, were examined and told about their activities. Mr. Willard testified that he was co-author of the "Connecticut Public Utilities Catechism," used in seventy high schools of his state. Mr. McCrum had taken part in opposition to the Boulder Canyon bill, acting, he said, at the behest of Mr. Oxley.

Other officials of public utility associations summoned to appear include Walter H. Johnson, Walter E. Long and A. G. McKenzie of Philadelphia and A. B. Millar of Harrisburg, representing electrical associations, bureaus or committees in Pennsylvania. A. B. Tunis and A. H. Herrmann of the Public Utilities Association of Virginia were summoned last week, but their testimony contained nothing of moment.

Senator Walsh took occasion last Friday to deplore from his seat a lack of public attention to the investigation and said that to insure greater publicity for the testimony elicited he would from time to time address the Senate on points revealed. Thus he will get extracts from the evidence into the *Congressional Record*.

Boulder Dam Debate Waxes Warm

Senator Ashurst of Arizona, Leading Opposition, Denounces Stand of California as Selfish—Chances of the Bill's Passage Thought to Diminish

By Paul Wooton
Washington Correspondent of Electrical World

WHEN the debate on the Boulder Canyon Dam bill began in the Senate last week some of its opponents were willing to concede that the bill would pass that chamber. After a week of debate, however, the chances of the bill to get through the Senate have diminished. In the meantime no progress has been made with the measure on the House side. The rules committee has had several hearings, but as yet has given no intimation as to its intention to give this legislation a preferred status.

Unquestionably the most effective point which is being made against the bill in the Senate debate is that the government cannot afford to embark upon an experiment with the highest dam ever built with insufficient engineering data. In view of the St. Francis Dam disaster it is being argued that the United States must be one hundred per cent sure before undertaking this project. The fact that Senator Smoot, the chairman of the finance committee, with all the prestige which goes with that position, is so vigorous in his opposition has had no little influence in building up sentiment against the legislation.

A determined filibuster against the bill, led by Senators Ashurst and Hayden of Arizona, is being aided by the legislative situation. The tax bill is certain to displace the Boulder Dam measure for a week or more. The conference report on the farm relief bill will take time and other appropriation bills have to be considered. In addition, various other important measures are on the calendar for which consideration is demanded, and if the President vetoes the flood prevention bill, that question will again be precipitated into the debating arena.

Senator Johnson of California, who is leading the fight for the bill, has contented himself with very limited remarks, mostly confined to explanations of the bill's provisions. He urged the passage of the measure as the duty of Congress to rescue sixty-five thousand Americans in the Imperial Valley from the threat of flood and to solve the international problem which exists on the lower reaches of the river.

Ashurst Versus Johnson

Senator Ashurst, who is leading the opposition, and between whom and Senator Johnson a heated exchange of words took place, takes strong exception to the constant references by the bill's supporters to the "power trust." He pointed out that all but one of the senators who are supporting the Johnson bill voted against the Walsh resolution. He declared that the Boulder Canyon Dam would offer no flood protection for the Imperial Valley within the lifetime of any one now occupying a seat in the Senate. He urged that Congress pass the bill providing for the protection of the Imperial Valley against flood and take up as a separate matter a decision as to whether or not Los Angeles should have potable water at the expense of the government and whether or not Los Angeles and other cities on the coast should have electrical energy at the expense of the government. He charged that the California senators fear that a flood-control dam might destroy their hope of obtaining water and electricity for their state at government expense.

In the course of the debate Senator Johnson expressed the opinion that Senator Ashurst had not offered his flood-control amendment in good faith. In reply Senator Ashurst said the project would have a better chance for approval when California statesmen speak with the voice of reason, instead of with the voice of selfishness and a "display of a forked tongue." He concluded those particular remarks by declaring that the present bill fails to square with the idea of fair play that even bullies and prize fighters hold.

Wants Sixteen-Hour Debate

Urging that the Boulder Dam bill be considered on its own merits irrespective of appeals to prejudice concerning the alleged interests of power companies in the contest, Representative Douglas of Arizona on May 2 asked the House rules committee, if it should give time for the consideration of the bill, to allow the opposition to the measure abundant opportunity to develop its case on the floor. "If you see fit to bring this bill before the House," he said, "sixteen hours of general debate will be necessary to inform the members of vital issues at stake concerning the interests of the people of seven states and an expenditure of $300,000,000."

Mr. Douglas put forward as his chief objection to the bill the incongruity of undertaking an enormous and expensive power development to provide against floods in a region where there is no pressing flood menace. He also took issue with the statement that Los Angeles needs an additional water supply, substantiating his point with a quotation from a California state engineer to the effect that the city at present has enough water for fifty years. In answer to statements that there is a great need for more power in southern California, Mr. Douglas pointed out that both the city of Los Angeles and the Southern California Edison Company reduced their rates in 1927 in order to stimulate demand.

In conclusion Mr. Douglas sounded the warning that the whole policy of the government is at stake in the issue. "If the government is to go into the power business at Boulder Canyon," he said, "the field will be opened to put it into any competitive line of business." He also declared that the government could construct a steam power plant at Los Angeles, if its object is power development, and save expense.

Despite requests of representatives from other Colorado Basin states that time be given them to make statements, Chairman Snell of the rules committee announced that he had given the subject all the time that he could and that the committee would now devote itself to the consideration of the rule.

Senator Smoot Takes a Hand in Boulder Dam Debate

An amendment in the form of a substitute for the Boulder Dam bill by which the problem of developing the Colorado River would be referred to a board of engineers which would make recommendations for flood-control measures was offered on May 1 by Senator Smoot of Utah. The Senator made the proposal at the close of a long speech begun on April 30, in which he criticised in detail the proposed engineering plans for the development of the Colorado River.

The Smoot substitute would make available an appropriation of $20,000,000 "for the purpose of carrying out the investigation and building the flood-control structures." If a storage dam is the type of flood-control structure decided on, Senator Smoot's proposal provides that the seven-state Colorado River compact shall be consummated before the dam is begun, or "if the present incomplete Colorado River compact proves too difficult of ratification, an easier compact, not involving the troublesome question of title to water rights, may be substituted."

Senator Smoot, who is chairman of the finance committee, also announced that he would call up the tax bill on May 3, after which he would seek to keep it continuously before the Senate until it is disposed of. This action will displace the Swing-Johnson bill on the calendar, at least temporarily.

Representative Berger "Goes the Whole Hog"

A national "superpower system" is provided in a bill introduced in the House on Monday by Representative Berger of Milwaukee, a Socialist. Declaring that the so-called "superpower lobby" represents "the most corrupting influence in the United States today," Mr. Berger said his measure is designed to bring about conservation of the nation's natural resources, the co-ordination of irrigation, flood control, navigation and hydro-electric power production, the enlargement and expansion of the Reclamation Service in the field of agriculture, and federal aid to states, cities, counties, districts and other political subdivisions in the development of superpower systems, with service at cost.

P. G. & E.'s New Mokelumne River Project

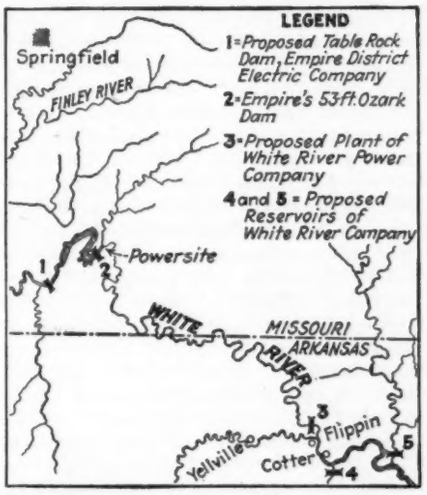
The Pacific Gas & Electric Company has filed with the Federal Power Commission an application for the further water and power development on the upper Mokelumne River, 50 miles northeast of Jackson, which has previously been described in the ELECTRICAL WORLD. The company proposes to erect a rock-filled dam, with a concrete face, approximately 300 ft. in height, 800 ft. thick at the base and 25 ft. wide at the top. The crest will be 1,300 ft. long and the storage capacity 130,000 acre-feet.

The application further calls for the erection of the Salt Springs power house at the base of the dam, which will have an installed capacity of 11,000 hp.; the construction of a concrete-lined canal and tunnels for the conveying of water from Salt Springs to a proposed regulating reservoir on Tiger Creek; the construction of a forebay on Tiger Creek from which water will be dropped approximately 1,200 ft. through penstocks to the proposed Tiger Creek power house, which will have an installed capacity of 67,000 hp., and the erection of a 110,000-volt power line from the Salt Springs power house to the Tiger Creek power house.

N.E.L.A. in Joint Conference on Shift of Industry

A joint conference of the policy holders' service bureau of the Metropolitan Life Insurance Company and the civic development committee of the N.E.L.A. was held in the Metropolitan Life Building in New York City on Thursday. The purpose of the conference was to discuss a survey of what industries are moving, where and why, and the relative advantages of small and large cities as manufacturing sites, and to consider ways in which the personnel of the two organizations can co-operate in collecting fundamental industrial economic figures. Preston S. Arkwright, president of the Georgia Power Company, is chairman of the N.E.L.A. civic development committee, containing thirteen prominent executives.

Projected Water Power in the Ozarks, 245,000 Hp.



RECENT granting by the Federal Power Commission of a preliminary permit to the White River Power Company for a long-mooted hydro-electric project in the Ozarks at the Missouri-Arkansas border has revived hopes of extensive new water-power development in that region. The permit embraces a 226-ft. dam near Cotter, Ark., with backwater to the Empire District Electric Company's Ozark dam at Powersite, Mo.; two high reservoir and power dams on the North Fork and Buffalo Fork and a series of low-head power dams between Cotter and Wall's Ferry. The aggregate immediate installation of the White River Power Company's project is placed at 165,000 hp. or more, and it is maintained that double this amount of power can be generated when required. The Empire District Electric Company on its part is sponsor for an 80,000-hp. project at Table Rock, in Stone County, Mo., further along the river, where a dispute with county authorities is delaying action.

Electrochemists at Bridgeport Discuss Batteries

The chemical production of electricity was the major topic of the American Electrochemical Society at the spring meeting held at Bridgeport, Conn., on April 26 to 28. More than two hundred members were in attendance.

Two sessions on Thursday dealt with primary cells. The modern dry cell was discussed in several papers with especial reference to life tests and depolarizers. One notable paper by Bruce K. Brown dealt with the use of graphitic oxide instead of manganese dioxide as a dry-cell depolarizer. The graphitic oxide gives a cell of lower voltage and is more expensive at the present stage of development but has promising possibilities. Marion Eppley gave two research papers on requirements in the production of standard cells. M. L. Martus discussed the caustic-soda battery and told about its characteristics. For the first time the technical details of the aluminum electrolytic rectifier were published in a paper by W. E. Holland, and a companion paper by H. O. Siegmund discussed the aluminum electrolytic condenser. Other papers dealt with storage batteries and storage-battery testing.

On Thursday night two excellent lectures were given. Dr. S. C. Lind, retiring president of the A.E.S., gave a lecture on the theory of chemical action in electric discharges in gases. He precipitated oils and solids from hydrocarbon gases by means of radium emanations and duplicated these tests with electric discharges. The second lecture was by Dr. Bergen Davis and dealt with the refraction of X-rays. These rays were observed by a double refracting spectroscope and their angle of refraction was measured.

Electrothermic applications of electricity were discussed on Friday. Robert M. Keeney, illustrating his paper with a film, described the growth of electric heat in industry and cited details of development in Connecticut. R. H. Leach gave operating data on the induction furnace for melting silver. C. M. Hoff told of the production of nitric and hydrochloric acid by use of electrodes immersed in the impure acids. By this means the resistance paths became heated and the boiling which resulted permitted distillation of pure acids. He said the new process replaced eight men with one and reduced production costs very greatly.

On Saturday the session was devoted to electrodeposition. Especial attention was given to chromium plating, and a noteworthy paper on this topic was presented by L. E. Grant and L. F. Grant. Chromium plating is looked upon favorably in industry, but to get good commercial results precision control and knowledge are required.

Visits were made to manufacturing plants in Bridgeport, Waterbury and New Haven. Paul J. Kruesi, president of the American Lava Company and other electrochemical concerns in Chattanooga, Tenn., was elected president. The fall meeting will be in Charleston, W. Va., on Sept. 20, 21 and 22.

A.E.S.C. Changes Its Procedure

Flexibility Made Main Element in Rules Adopted to Speed National Standardization—Steps in Development and Approval Are Listed

EXTENSIVE revision of its rules of procedure to speed industrial standardization work on a national basis is announced by the American Engineering Standards Committee. The chief object in broadening the procedure has been to make it so flexible that it may easily fit all of the varied conditions to be met in the wide range of industrial subjects covered by the committee's work. The revision is based upon the experience of the committee during its nine years of activity as a national standardizing body.

Three important changes are made in the procedure. Heretofore each sectional committee—essentially a joint committee composed of representatives of the various groups interested in the particular work in hand—has acted under the administrative support and direction of one or more of the interested bodies, which have been termed sponsors. A sectional committee may now operate autonomously, reporting directly to the A.E.S.C., or it may act under sponsors as before. The second change recognizes "proprietary" standards and makes possible the revision of such standards within a single organization on condition that it be shown that a standard is acceptable to the groups concerned. This method is particularly applicable to highly specialized fields in which the standard of an organization has already achieved a position of recognized eminence. The third change provides for very simple cases. The approval of standards under such cases is based upon the action of a conference followed by written acceptances of the interested groups.

The revised procedure states that the different methods are founded on the principle that the basic test to be applied in all cases is the fact of the assent, affirmatively expressed, of the groups having substantial interest in the standard. Such groups have an inherent right to representation on the body dealing with the subject matter of the standard, but it is not essential that this right be exercised.

The steps in the development on revision of a standard by a sectional committee will be:

1. Standardization proposed by responsible body.
2. General conference called by the A.E.S.C. to consider proposal and to decide whether the work shall be done; if so, whether the sectional committee shall operate under a sponsor or autonomously.
3. Recommendation of conference acted upon by A.E.S.C.
4. Organization of a sectional committee.
5. The make-up and personnel of sectional committee approved by the A.E.S.C.
6. Standard drafted by sectional committee.
7. The draft standard published or circulated for criticism.
8. Proposed standard approved by sectional committee by letter ballot.
9. Proposed standard approved by sponsor, if there be a sponsor, or formally indorsed by at least one co-operating body if the sectional committee is autonomous.
10. Standard approved by the A.E.S.C.
11. Standard published by sponsor or by the A.E.S.C. if sectional committee is autonomous.

The steps in approval of existing or proprietary standards will be:

1. An existing or a proprietary standard submitted to the A.E.S.C. for approval by a responsible body.
2. Investigation of facts regarding consensus through A.E.S.C. agencies, or the development of the acceptability of the standard through a representational committee.
3. Standard approved by the A.E.S.C.
4. Standard published.

The steps in the development of a standard by general acceptance will be:

1. Standardization proposed by a responsible body.
2. Survey of field made and draft standard produced by working committee.
3. Draft standard considered by general conference.
4. Proposed standard formally accepted by groups concerned.
5. Standard approved by the A.E.S.C.
6. Standard published.

The governing authority of the American Engineering Standards Committee is at present vested in 63 men, representing 36 national organizations, industrial, technical and governmental. About 350 national organizations are officially co-operating in the work, with 2,100 individuals engaged on various committees. Up to the present time 111 national standards have been approved, and 164 additional projects representing almost all branches of industry are under way.

"Teach Children to Respect Utilities"

Before State Association Governor Baker of Missouri Advocates Public Instruction Concerning Them—Glowing Predictions Made About Farm Service

FOUR hundred representatives of Missouri utility companies attended the three-day convention of the Missouri Association of Public Utilities at Jefferson City on Thursday to Saturday of last week. The address of welcome, delivered by Governor Sam A. Baker, went further than to express the customary amenities. The Governor strongly advocated the study in the public schools of the state of public utilities and the service they render. "I believe the public school curriculum should be so modified as to have a place for public utilities," he said. "Teach the children from the time they know anything to respect public utilities and to have some knowledge of them. There are still some of our greatest educational institutions that never undertake to teach anything about public utilities. We have the school of journalism, we have the school of engineering, we have the school of pharmacy, we have the medical school, and we should, right along with these activities, teach the benefits of public utilities."

A miniature electrified farm was an exhibit of the convention as the joint contribution of the agricultural colleges and the power and light companies of Missouri, Iowa, Kansas and Nebraska. R. R. Parks of the Missouri Agricultural College, Columbia, had charge of the farm. President W. H. Henby in his address predicted that eighty thousand Missouri farms will be electrified by 1948 and that the total cost of this development to the farmers and utilities will be about $200,000,000. He declared that the electrification of farms is the biggest task before the utilities, that rapid progress is being made and that the job will be done. He said that about five thousand Missouri farms are now using electricity.

"There is a vast field open to the utilities in assisting the chambers of commerce and other civic organizations in industrial development of the communities in which they operate," F. S. Dewey, vice-president of the Kansas City Power & Light Company, declared. He pointed out that the kilowatt-hours of electricity and cubic feet of gas produced by the utilities form a good measuring rule in determining the industrial development of any given territory.

Earle W. Hodges, director of public relations for Henry L. Doherty & Company, said that whether a public utility was a "good citizen" depended very largely upon its employees. Missouri utilities, he said, are following the proper trend by instilling into their workers civic and state pride. He advocated newspaper advertising to keep the utilities in close touch with the public.

L. A. Petit, Jr., operating vice-president of the Missouri Power & Light Company, Kansas City, Mo., in an address on Friday pictured electricity as an economic and social equalizer and declared that the liberal use of electric power in industry has done more to improve the standard of living and to increase per capita wealth in America than any other single thing. It has also, he said, increased the productivity of labor, thus making possible higher wages and a shorter work day. It would make decentralization of industry possible and raise agriculture to the same plane of prosperity that industry has occupied.

L. A. S. Wood, manager of the street-lighting section of the Westinghouse Electric & Manufacturing Company, South Bend, Ind., spoke on "The Public Utility Company's Responsibility in Relation to Street Lighting," and W. L. Berry, assistant sales manager of the Union Electric Light & Power Company, spoke on "Load Building."

Thomas J. Brown, chairman of the Missouri Public Service Commission, was the only speaker at the annual

banquet, held at the Missouri Hotel on Friday night. The trend of his remarks was that the public utility is as much an agent and servant of the public as are members of the commission and he urged a better understanding of the meaning of state regulation and the workings of the commission, whose duty it is to see that good service is furnished and that the company in return has just and adequate rates. "Regulation means to a great extent the elimination of competition" he continued. "When I became a member of the state commission I was firmly convinced that competition should not be eliminated. I am now entirely 'sold' on the idea of state regulation."

A feature of the final session on Saturday morning was a technical paper on the steam-heating business prepared jointly by W. C. Kaber, engineer of the steam-heating department of the Union Electric Light & Power Company of St. Louis, and T. S. Ayers, superintendent for the same company.

New officers were elected as follows: President, A. E. Reynolds, Springfield Gas & Electric Company; first vice-president, T. J. Stricker, Kansas City; second vice-president, E. D. V. Dickey, Hannibal; third vice-president, Samuel W. Greenland, St. Louis; secretary and treasurer (re-elected), F. D. Beardslee, St. Louis.

Progress in Electric Welding Reviewed by Society

Continued progress in the art of fusion welding by electric and gas processes was made evident by papers, discussions and committee reports at the annual spring meeting of the American Welding Society, held at the Engineering Societies Building, New York, April 25, 26 and 27. This progress, it was shown, is mainly in the perfecting of technique, the establishment of preliminary standards for qualifying welders and supervising their work and the advancement of the test programs for welded pressure vessels and steel structures.

At a meeting of the pressure-vessel committee it was pointed out that the support of tank manufacturers and manufacturers of electric welding equipment is needed to insure an early start on an extensive test program to be carried on jointly by the American Welding Society and the American Society of Mechanical Engineers. These tests will supply essential data sought by the A.S.M.E. boiler code committee as a basis for proposed modifications in the code for unfired pressure vessels.

The meeting of the structural steel welding committee brought out the fact that funds for a similar structural research program are fully subscribed, assuring the completion of tests to establish unit stresses and other data.

A preliminary progress report on qualifications of welders, inspection and supervision was presented by H. H. Moss and A. M. Candy. This covered the fields of structural steel and industrial piping and was followed by prepared discussions covering structural steel, piping and pressure vessels.

The meeting closed with a session on the welding of the new Ford car, in which all processes are used, and a meeting of the American Bureau of Welding, at which the progress made by various research committees of the society was reviewed.

Officers elected for the ensuing year are: President, F. T. Llewellyn; senior vice-president, A. E. Gaynor; divisional vice-presidents, Ernest Lunn, J. W. Meadowcroft and H. P. Peabody.

Purchases and Mergers

Ashtabula, Ohio, Votes to Sell Municipal Plant if $2,225,000 or More Can Be Realized—$2,000,000 Cash Offered for Freeport (N. Y.) Municipal Plant

VOTERS of Ashtabula on April 24 approved a proposal to sell the municipal light and power plant for not less than $2,225,000. The issue carried by a majority of 1,036 votes. Last November a similar proposal was defeated by 32 votes. The voters last week also authorized the Cleveland Electric Illuminating Company to extend its lines inside the city limits of Ashtabula to serve the docks and railroads. Ashtabula, which has a population of 25,000, is the largest city in Ohio depending for electric service entirely on a municipal plant. The Public Ownership League of America devoted eleven pages of *Public Ownership*, its monthly journal, edited by Carl D. Thompson, to arguments against authorizing the sale.

The Long Island Lighting Company has made a formal offer to the Village Trustees of Freeport, N. Y., to buy the municipal light and power system for $2,000,000 cash. The sum would, it is said, wipe out Freeport's bonded indebtedness and leave a margin. It is expected that public opinion on the matter will be indicated at a proposed forthcoming referendum on the question of floating a bond issue of $250,000 for the purchase of equipment for the municipal plant. The Long Island Lighting Company's offer will hold good until Nov. 1.

Acquisition by the American & Foreign Power Company of the Mexican Utilities Company is announced. The Mexican Utilities Company was organized in 1925 and controls the Guanajuato Power & Electric Company and the Central Mexico Light & Power Company. Irving W. Bonbright is chairman of the board.

The proposed merger of the Washington (D. C.) traction companies, now before Congress, has attracted criticism at the hearings of the District committee of the House, where William A. Roberts of the Federation of Citizens' Associations declared that control of the Washington Railway & Electric Company and the Potomac Electric Power Company reaches back to the North American Company. He expressed the opinion that the La Follette anti-merger act makes unlawful the indirect control which, under the proposed plan, the North American might have over the local power supply and the potential source at Great Falls in view of its holdings in the Washington Railway & Electric. The Senate committee is understood to be waiting on the House, and doubt is expressed whether final action will be taken this session.

The Central Hudson Gas & Electric Corporation has made application to the New York Public Service Commission for authority to acquire for $500,000 all of the outstanding capital stock and mortgage bonds of the Red Hook Light & Power Company and the outstanding stock of the Ducci Realty Corporation, which owns real estate and water rights in Bingham Falls, Columbia County, where the Red Hook hydro-electric company's plant is located. The Central Hudson Gas & Electric Company has also made application for authority to acquire the outstanding capital stock of the Millerton Electric Light Company, serving Millerton and the town of Northeast, in Dutchess County, and for approval of the merger of the Millerton company with the Central Hudson Gas & Electric. The Millerton company is now controlled by the Connecticut Power Company of New London. The price stated is $105,000 in cash and 2,000 shares of Central Hudson non-par-value common stock.

Sale of the Waverly (Ohio) municipal light plant to the Ohio Utilities Company took place recently.

The Ohio Electric Power Company of Oberlin has purchased from the New Bremen corporation the transmission and distribution line serving the village of Lock Two. New Bremen obtains its own energy from the company.

Purchase of the electric light system at Sharpsburg, Ky., by the Kentucky Electric Development Company, Louisville, is announced. This company has been in operation a little more than a year and now furnishes power for seven towns in Pendleton and Shelby Counties.

When the Stonewall Power Company sold out its entire interests last week to the Virginia Public Service Corporation of Charlottesville, for approximately $250,000, a fight for the right to supply electric light and power to Mannassas and Prince William County was brought to a conclusion. About a year ago the Virginia Public Service Corporation made the Town Council of Manassas an offer of between $80,000 and $90,000 for its franchise, power plant and lines. This offer was rejected by the Town Council. A few months later a corporation, with headquarters in New Jersey, known as Rivers & Streams, Incorporated, began the construction of a dam at Bland's Ford, on Occoquan Run, and acquired all lines and rights outside of Manassas, subsequently selling out to the Stonewall Power Company.

The municipal electric light, water and ice plants in Donalsonville, Ga., have been sold to the Georgia Power & Light Company, not to the Georgia Power Company, as erroneously reported last week.

Jonesboro (Ark.) citizens are at loggerheads over the proposed sale of the municipal water and light plant, a property owners' league advocating disposing of it for $1,200,000.

On April 1 the electric and gas properties of the Central Power & Light Company at Natchez, Miss., were transferred to the Southwestern Gas & Electric Company, an operating subsidiary of the Central & Southwest Utilities Company, because of the great distance separating Natchez from the remaining properties of the Central Power & Light Company and the proximity of Natchez to the properties of the Southwestern Gas & Electric. All are Insull companies.

James R. Darby, owner of the Weimar (Tex.) Power & Light Company, has sold the business to the Middle States Utilities Company, with headquarters at Chicago.

That company also has purchased the La Grange (Tex.) Light, Power & Water Company.

The Walterboro (S. C.) municipal electric plant has been bought by the South Carolina Power Company for $56,000.

Fifty thousand dollars has been offered for the Benson (Minn.) municipal electric plant by the Otter Tail Power Company. Engineers have informed the city that it would take $223,000 to modernize the plant.

An offer of about $57,500,000 by the Power Corporation of Canada, through A. J. Nesbitt of the Nesbitt, Thomson Company of Montreal, for the British Columbia Electric Railway Company brings the number of bids recently made for control of the latter property to four, of which the one just referred to is much the highest. The other three bids include a previous one from the Nesbitt interests, one from the Holt interests of Montreal and one from Lord Rothermere and his associates in England, where the company's stock is now held.

Briefer News

NEW TRANSMISSION LINE FOR IOWA.—A 47-mile high-tension line connecting the Northwestern Light & Power Company plant at Sibley, Iowa, with George, Boyden, Little Rock and Hull is being planned by the utilities company and will be started soon. The approximate cost is $100,000.

POSSIBILITIES OF CHILCO RIVER WATERSHED IN BRITISH COLUMBIA.—The government of British Columbia will take steps this summer to determine definitely the water-power possibilities of the Chilco River country, midway between Vancouver and Prince George, over which a water-power reserve was placed a year ago. The water powers of that locality have been estimated to be capable of developing 1,000,000 hp., and the government will now send a survey party to make scientific measurements. This will probably take three years.

MECHANICAL ENGINEERS' PITTSBURGH MEETING.—"Some Economic Factors in Power-Station Design," by H. B. Brydon, and "High-Pressure Steam Boilers," by George A. Orrok, are the two papers scheduled for presentation on Thursday morning, May 17, at the central-station power session of the spring meeting of the American Society of Mechanical Engineers. This meeting will be held at the William Penn Hotel, Pittsburgh. On the preceding day there will be two papers dealing with engineering education—"Industrial Co-operation in Education," by A. T. Jewett, and "Education and Training as Applied to the Engineer," by F. L. Bishop.

MOUNTAIN STATES POWER MOVES BACK TO ALBANY, ORE.—Moving of the general offices of the Mountain States Power Company from Tacoma, Wash., to Albany, Ore., was effected early in April. The operating and treasury departments were moved to Tacoma from Albany about two years ago, at which time the engineering and electric new-business departments were kept at Albany so as to be near the center of the Willamette Valley Division. The principal officials returning to Albany in the present move are Vice-President C. M. Brewer, General Auditor W. L. Fitzpatrick, and John N. Adams, head of the publicity department.

MISSOURI PUBLIC SERVICE COMPANY TO HAVE HEADQUARTERS AT WARRENSBURG.—The Missouri Public Service Company will by June 1 establish its general headquarters at Warrensburg, Mo. The company now serves eighty towns in western Missouri.

NEW PLANT AT YOAKUM, TEX., FOR TEXAS-LOUISIANA POWER.—The Texas-Louisiana Power Company will construct a new electric power plant at Yoakum, Tex., at a cost of $150,000, it is stated. The company also plans to construct a system of power transmission lines in that part of the state, invading the field which is now occupied almost exclusively by the Central Power & Light Company.

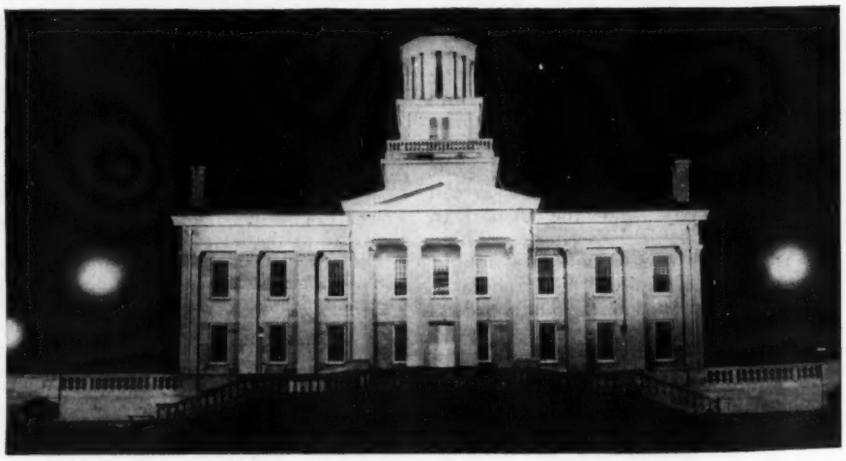
LINE EXTENSIONS IN OKLAHOMA.—The Southwestern Light & Power Company has started construction on a 33,000-volt electric transmission line from Duncan to Addington and from Waurika to Ryan, guaranteeing uninterrupted service by a loop connected to the company's generating plant at Lawton and its standby plant at Waurika. The company is also constructing a 33,000-volt line from Clinton to Arapaho and a distribution system at Arapaho. The 22,000-volt line from Hammon to Cheyenne and Strong City is finished, as are also the distribution systems in Cheyenne and Strong City. Erection of the steel towers for the Red River crossing to connect with the transmission systems of the Southwestern Light & Power Company at Frederick and the West Texas Utilities Company at Vernon has been completed in recent weeks.

NEW UNIT FOR TORONTO (OHIO) PLANT NEARLY READY.—The fourth unit of the Pennsylvania-Ohio Power & Light Company's plant at Toronto, Ohio, will soon go into operation, increasing the capacity of that station from about 112,500 kva. to 150,000 kva. The third unit was installed only last fall.

TO ENLARGE CHIHUAHUA HYDRO PLANT.—Plans of the Mexico Northern Power Company for increasing the capacity of its hydro-electric plant in La Boquilla, State of Chihuahua, and construction of a large irrigation system have been approved by the Mexican government. The improvements will cost approximately $1,500,000 United States money, it is stated. This company is owned by Canadian interests. It constructed a large dam across the Conchos River about twenty years ago and installed a hydro-electric plant which, by means of transmission lines, furnishes power and light for Parral, Chihuahua, Santa Rosalia and a number of mining districts.

NORTHERN NEW YORK UTILITIES TO DEVELOP 12,000 HP. ON BEAVER RIVER.—The Northern New York Utilities of Watertown, N. Y., will immediately start the development of water power at Mosher Falls on the Beaver River, where about 12,000 hp. will be developed, two units of 6,000 hp. each being installed. An additional development of 12,000 hp. may be made later. It is expected that the work will be finished this year. The Mosher Falls has a 216-ft. head. A concrete dam 100 ft.

Floodlighting Embellishes the Original Capitol of Iowa



THE dignified simplicity of Iowa's "Old Capitol" at Iowa City is especially well brought out at night by floodlighting. Four L-15 1,000-watt projectors are used to light up the tower; 12 L-1 500-watt projectors light the remainder of the building. The lighting installation was made by the General Electric Company. The old building has been termed the cradle of Iowa, as it was the first Capitol of the state. It is now the heart of the University of Iowa and houses all the administration departments of the university.

high and 1,000 ft. long is to be constructed, and 10,000 ft. of pipe line, 10 ft. in diameter, is to be laid to the surge tank, two miles away. About 320 acres of timber land will be flooded.

ROCHESTER GAS & ELECTRIC WANTS ADDITIONAL LAND ON GENESEE. — The Rochester Gas & Electric Corporation has filed with the New York Public Service Commission a petition requesting the commission to find, in accordance with the conservation law, that certain real property on the Genesee River in the city of Rochester is necessary to the improvement and full utilization of the company's water-power development in that city. Under the law the commission must make such a finding before the petitioner can institute condemnation proceedings. The commission will fix a date for a public hearing.

PLANT TO BE BUILT AT ABERDEEN, WASH., WHILE AWAITING COWLITZ POWER.—The Grays Harbor Railway & Light Company, Aberdeen, Wash., will build an extension to its central generating plant at Electric Park, to cost $1,500,000, W. W. Briggs, vice-president and general manager, announces. The new unit will develop 10,000 hp. and will more than double the capacity of the station. Mr. Briggs also announces that the construction of this unit will in no way interfere with the ultimate development of the Cowlitz power project, but that it is being built to provide for industrial expansion expected before the Cowlitz power becomes available five years hence.

SENATE PASSES BILL FOR HYDRAULIC LABORATORY.—The United States Senate on April 13 passed the Ransdell bill authorizing the establishment of a national hydraulic laboratory in the Bureau of Standards. A similar bill was introduced by Senator Ransdell in 1922 by request of the American Engineering Council in an effort to carry out a recommendation made by John R. Freeman. The commerce committee on two previous occasions reported the bill favorably and urged its passage, but it took the flood of 1927 to muster the necessary support behind the bill to insure its success. The bill was supported strongly by Secretary Hoover. It authorizes an appropriation of $350,000.

NEGOTIATION UNDER WAY FOR ELEPHANT BUTTE POWER.—During the past year the El Paso Electric Company has been carrying on negotiations with the Water Users' Association looking toward construction of an 18,000-kw. power plant at Elephant Butte Dam in New Mexico and a transmission line to El Paso by the Water Users' Association and purchase of the power by the El Paso Electric Company. Elephant Butte Dam was constructed several years ago for irrigation purposes only, but engineers estimate that approximately 18,000 kw. of power will be available for a few months out of each year and it is this power that the electric utility would buy. An agreement has been worked out and is now under consideration by the Water Users. It will be necessary for them to secure approval of the Secretary of the Interior.

NEBRASKA'S STATE PLANT IS STARTED. —The new power plant built by the State of Nebraska at the state penitentiary, 5 miles south of Lincoln, at a cost of $150,000, has been put into service and will light all state institutions in and about the city, including the ten-million-dollar Capitol, now nearing completion. The state refused to contract for energy with the Iowa-Nebraska Light & Power Company. It claims that the new plant has a fuel-saving capacity of 50 per cent over the old equipment.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see ELECTRICAL WORLD for Jan. 7, page 80.]

American Institute of Electrical Engineers—New Haven regional meeting, May 9-11; national convention, Cosmopolitan Hotel, Denver, June 25-29. F. L. Hutchinson, 33 West 39th St., New York.

Middle West Division, N. E. L. A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

Arkansas Utilities Association—Arlington Hotel, Hot Springs National Park, May 14-16. R. I. Brown, Arkansas Power & Light Co., Little Rock.

American Society of Mechanical Engineers—Pittsburgh, May 14-17. Calvin W. Rice, 29 West 39th St., New York.

Indiana Electric Light Association (jointly with Indiana Public Utilities Association) — Columbia Club, Indianapolis, May 22-24. William Stokes, 1548 Consolidated Bldg., Indianapolis.

National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.

American Association of Engineers—Hotel Hussman, El Paso, Tex., June 4-6. M. E. McIver, 63 E. Adams St., Chicago.

Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 5-8. E. Donald Tolles, 165 Broadway, New York.

National Electrical Manufacturers' Association—The Homestead, Hot Springs, Va., June 11-15. S. N. Clarkson, 420 Lexington Ave., New York.

Pacific Coast Division, N.E.L.A. — Hotel Huntington, Pasadena, Cal., June 12-15. S. H. Taylor, 447 Sutter St., San Francisco.

Georgia Electrical Association—Savannah, June 14 and 15. J. J. McDonough, Georgia Power Co., Dublin, Ga.

Northwest Division, N.E.L.A.—Portland, Ore., June 19-22. B. Snow, 1208 Spalding Bldg., Portland, Ore.

Canadian Electrical Association—SS. "Richelieu" from Montreal to Saguenay and return, June 20-23. H. M. Lyster, 712 Power Bldg., Montreal.

Association of Iron and Steel Electrical Engineers—Hotel Stevens, Chicago, June 25-28. J. F. Kelly, Empire Bldg., Pittsburgh.

American Society for Testing Materials — Chalfonte-Haddon Hall, Atlantic City, N. J., June 25-29. C. L. Warwick, 1315 Spruce Street, Philadelphia.

East Central Division, N.E.L.A.—Cedar Point, Ohio, July 10-13. D. L. Gaskill, Greenville, Ohio.

CHIEF JUSTICE WILSON OF MAINE NAMED MASTER IN CAMBRIDGE CASE.—Chief Justice Scott Wilson of the Supreme Court of Maine has been appointed master to hear the case brought by the Cambridge Electric Light Company against the Massachusetts Department of Public Utilities in connection with the commission's order reducing its maximum residential and commercial lighting rate from 8 cents to 5.5 cents per kilowatt-hour.

MIDDLE WEST N.E.L.A. MEETS AT ST. LOUIS NEXT WEEK.—About four hundred delegates are expected to attend the annual convention of the Middle West Division of the National Electric Light Association, composed of electric light and power companies in Missouri, Iowa, Kansas and Nebraska, to be held in St. Louis on May 9, 10 and 11. The proposed method of Mississippi River flood control will be discussed by Major George R. Young. Judge C. W. Appleton, vice-president of the General Electric Company, will discuss "Government in Business." Public utility financing will be presented from a banker's viewpoint in an address by A. C. Allyn of Chicago. Prominent representatives of the parent body also will address the gathering.

THIRD UNIT AT BARTLETT'S FERRY, GA., TO GO IN THIS YEAR. — Preliminary work on an extension to the Bartlett's Ferry hydro-electric station of the Columbus (Ga.) Electric & Power Company is finished, and unit No. 3 will be installed, it is announced, by Sept. 1. Like the two previous units, the new generator will be rated at 22,000 hp., thus increasing the plant's capacity to 66,000 hp. Ultimately a total of 110,000 hp. may be installed. New steel penstocks, control equipment and a transmission substation form part of the work to be done this summer. The new unit will consist of a General Electric generator and an Allis-Chalmers waterwheel. The two units already in service are of Westinghouse and S. Morgan Smith manufacture.

DEVICE FOR "SHOCKING AWAY" TRESPASSING FISH.—J. E. Yates, electrical engineer for the Pacific Power & Light Company in Oregon, claims to have perfected a safety device by the use of which hydro-electric utilities may prevent the destruction of fish by turbine wheels. According to the State Fish Commission, Mr. Yates' invention is the first of the kind to be successfully used. It consists of two rows of parallel electrodes suspended from a wooden framework above the water. The rows are 4 ft. apart and the electrodes 3 ft. apart. The electrodes are at approximately the same level near the bed of the stream. An electric field set up about the electrodes will reach in equal strength from the surface of the water to the bottom of

the stream. Its strength will taper off in proportion to the distance upstream and downstream from the center of the field. The device is so constructed that when a fish approaches a tailrace it will swim into the edge of the electric field and either be immediately turned back or, if it attempts to enter the field farther, a still greater shock will be sufficient to discourage this procedure. A field current of 3 volts or 4 volts is ample to divert a 30-in. salmon, it is contended, and yet will do the fish no harm even if it swim entirely through the field. The first of these devices are being installed at the various dams of the California-Oregon Power Company.

UNDERGROUND TRANSMISSION FOR ROCHESTER, N. Y.—Plans to clear the city of Rochester of light and power poles within five years by placing all electric cables within the city limits in underground conduits are announced by the Rochester Gas & Electric Corporation through Thomas H. Yawger, superintendent of the electrical department. The plan ties in with the company's project to remove all lines from weather hazards, Mr. Yawger said.

NORTHERN INDIANA PUBLIC SERVICE PLANS NEW POWER HOUSE.—Construction of a large electric generating station at Michigan City, Ind., on the lake front by the Northern Indiana Public Service Company will begin early in 1929, according to an announcement just made by the company, though operation will not begin until 1931. The first unit—a 60,000-kw. turbine—has been ordered and will be built by the Westinghouse Electric & Manufacturing Company. That part of the building to be erected next year will afford room for a second unit of the same size. The estimated cost of the initial construction is approximately $9,000,000. Plans for the construction of a generating station in Michigan City were announced originally in November, 1925, soon after the site was purchased. A large substation has been built there since that time and is an important distribution center.

PROVINCE OF ALBERTA AND CALGARY POWER COMPANY MAY BE RIVALS FOR GHOST RIVER POWER.—Dispatches from western Canada indicate that the Calgary Power Company is seeking a license for development of hydro-electric power on the Ghost River, which rises in the Banff National Park, north of Lake Minnewanka, in the Province of Alberta. The Calgary Power Company, which operates power plants on the Bow River, has greatly extended its service north and south along the "backbone of the province," from Lethbridge in the south toward Edmonton in the north, and has applied for the right to develop 75,000 hp. from the Spray Lake site, also in the national park. The situation is complicated by the fact that the natural resources of Alberta may soon be turned over by the Dominion government to the province, which may seek to develop a hydro system of its own.

Recent Court Decisions

NOVEL CASE OF MIXED FEDERAL AND STATE JURISDICTION.—Levin and others brought suit against the Philadelphia Electric Power Company to restrain the operation of the transmission line from Conowingo until alleged damages to their property situated near the right-of-way had been ascertained and paid. In denying an injunction, the United States District Court for the Eastern District of Pennsylvania said that the plaintiffs' action was based (a) on an act of Congress according right of action to any one whose property is damaged by operation of the transmission line as distinguished from its construction, (b) on an easement owned by the plaintiffs in the land traversed, and (c) on the allegation that the defendant was threatening to break its covenants. This, the court said, brought about a novel case of mixed jurisdiction, since (a) belonged to the federal courts and (b) and (c) to the state courts. In such a case a United States court could assert jurisdiction over the whole proceedings, but this principle did not call upon it to grant the relief asked. The act of Congress involved gave no right to security in advance of judgment. (23 Fed. [2d] 508).*

POWER COMPANY RIGHTS IN NATIONAL FORESTS.—A suit brought by the United States against the Southern Power Company of South Carolina, which involved important problems in relation to control of lands embraced within national forest reservations, has been decided in the United States District Court of South Carolina in favor of the company, whose right to maintain power lines across tracts of land included within the Nantahala National Forest is sustained. The power company urged that the rights claimed by it were in existence at the time the forest was created and that the Weeks act, under which the land was taken to be a part of the national forest, does not empower the government to condemn and take easements and similar rights already used in public service; also that the power company relinquished its easement rights and permitted the government to take title to the land in its condemnation proceedings upon the agreement of the government to grant the company a permit to occupy the lands for the use of its power lines. The question of appeal is under consideration in the Department of Justice.

RIGHT TO CROSS POWER LINE WITH AËRIAL UPHELD.—In the New York Supreme Court, sitting in Albany County, $30,000 damages was granted by a jury to B. G. Troidle, a physician, against the Adirondack Power & Light Corporation because of severe burns said to have been incurred when 2,300 volts of electricity passed through his body after he had thrown an aërial wire over the company's power line at his camp at Ballston Lake. The plaintiff claimed that the insulation of the power line had been worn by the weather. Troidle testified that he had attached the wire to the garage at his camp and then thrown it over the power line, to run it to his cottage, loosening his hold on it at the same time; that the circuit formed when the wires came in contact flung the aërial wire back against him, and that when he tried to ward it from his face the 2,300 volts passed through various parts of his body, burning him in fourteen places. Dr. Troidle purchased his camp site from the Schenectady Railway Company, from which the Adirondack Power & Light Corporation obtained permission to string its wire overhead. The doctor's lease did not invalidate the company's right in this respect, it was shown. Lawyers believe it is the first instance where a court has upheld the right of a property owner to erect an aërial across the lines of a power company.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

OREGON COUNTY COURT CLAIMS REGULATORY POWER OVER LINES BUILT UNDER BLANKET FRANCHISE.—Before the Marion County (Ore.) Court will grant an application for a blanket franchise to construct electric transmission lines throughout the district, it must first receive the assurance of the necessary authority not only to direct the location of proposed lines but to order that changes be made in routing following construction. This attitude was assumed by the court in connection with an application filed by the Molalla Electric Company, a subsidiary of the Portland Electric Power Company, and the operating field principally affected is that between the capital and Portland.

Commission Rulings

SHOULD RATE REDUCTION IN METROPOLITAN DISTRICT APPLY OUTSIDE CITY LIMITS?—On its own motion the Oregon Public Service Commission ordered an investigation for the purpose of determining whether the reduction of electric light rates in Portland under the proposed merger plan of the utilities there would apply to service furnished by the operators outside of the metropolis. The Portland Electric Power Company, a utility engaged in intrastate business and a party to the proposal, renders service to the towns of Oregon City, Hillsboro, Salem and several smaller communities between the capital and Portland. In the plans introduced for the merging of the Portland plants nothing was mentioned regarding the consumers beyond the municipal limits wherein the merger was to be effected, and the commission decided to undertake an investigation to discover any possible discrimination.

FAIR DIVISION OF TERRITORY DOES NOT MEAN INDEFINITE PRE-EMPTION.—Approval was bestowed by the Public Utilities Commission of Colorado upon an agreement between the city of Fort Morgan and the Public Service Company of Colorado as to the division of certain territory to be served by their respective electric utility plants. When, however, the commission learned that, in addition to the territory which was to be served immediately, the Public Service Company had agreed to give the city of Fort Morgan the first chance to serve the customers in another area and that the city did not desire or consent to render the service at any time in the near future, the commission said: "The commission is of the opinion that it would be unwise and contrary to the public convenience and necessity to pre-empt this territory in favor of a utility which may never be willing to serve it. . . . Therefore no certificate authorizing such service should be issued.

News About Men of the Industry

C. J. Eaton Vice-President of Middle West Utilities

Chester J. Eaton, for the past nine years commercial manager of the Middle West Utilities Company, has been elected vice-president of that company, in charge of merchandising and sales. Mr. Eaton's promotion follows a wide experience in commercial work with

C. J. Eaton

public utilities and he is a recognized leader in the application of practical methods of developing increased use of electric services and in the popularization of appliances. Prior to taking charge of merchandising operations for the Middle West Utilities Company in 1919, Mr. Eaton directed the new-business activities of the Kentucky Utilities Company from 1912 to 1917 and of the Interstate Public Service Company from 1917 to 1919. He was associated with the Union Electric Company of Dubuque, Iowa, for two years and previous to that was engaged in commercial work for the Commonwealth Electric Company and the Chicago Edison Company before their consolidation into the present Commonwealth Edison Company.

Mr. Eaton has been prominently identified with the activities of the Commercial National Section, N.E.L.A., and it is largely through his work as chairman that the committee on electrical advertising has organized and conducted its special training schools for central-station lighting salesmen. He is also chairman of the committee on employee use and selling of the electric range.

PAUL J. KRUESI of Chattanooga, Tenn., was elected president of the American Electrochemical Society at the recent convention held in Bridgeport, Conn. Mr. Kruesi's business interests have been centered in Chattanooga since 1902, when he became secretary-treasurer and manager of the American Lava Company. At the present time he is president and owner of that organization as well as president of the Chattanooga Electro Metals Company and of the Southern Ferro Alloys Company, not to mention other business interests of varied character. Before removing to the South Mr. Kruesi was identified with the General Electric Company, the Chicago Edison Company, the General Incandescent Arc Light Company, the Paragon Fan & Motor Company and the Wright Discount Motor Company. In addition to being prominent in the American Electrochemical Society, he is a member of the American Institute of Electrical Engineers, the American Iron and Steel Institute and other societies.

I. W. Day New President of New England Division

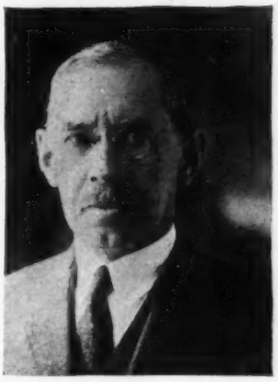
Irvin W. Day, who was elected president of the New England Division of the National Electric Light Association at its annual meeting in Boston last week, is a well-known figure among the younger public utility executives of the Northeast. He was graduated from Cornell University in 1906 and spent several years in the steamship business. In 1912 he became assistant secretary and two years later secretary and treasurer of the United Electric Light & Water Company, Waterbury, Conn. Upon the merger of that company with the Connecticut Light & Power Company in 1917 Mr. Day was elected vice-president and a director of the merged company. When the Connecticut Electric Service Company was organized in 1925 as a holding company for the Connecticut Light & Power Company and a number of other public utilities of the Nutmeg state Mr. Day was also elected a vice-president and director of the latter organization. He is interested in

I. W. Day

and a director of a number of other companies and has been active in civic enterprises in the Naugatuck Valley. He has been an influential factor in the building up of a far-reaching Connecticut system noted for engineering excellence, commercial enterprise and sound public relations.

W. J. Serrill to Head Standardization Movement

William J. Serrill, assistant general manager of the United Gas Improvement Company of Philadelphia, has been elected to the chairmanship of the American Engineering Standards Committee. Mr. Serrill succeeds C. E. Skinner of the Westinghouse Electric &



W. J. Serrill

Manufacturing Company, who has been chairman of the standards committee for the past three years.

Mr. Serrill has been prominent in standardization activities in the gas industry, and as representative of the American Gas Association he has been identified with the national standardization movement for several years. He has been active in the affairs of the Illuminating Engineering Society, having served as treasurer, vice-president and president. He is a graduate of the University of Pennsylvania. The vice-chairman will be CLOYD M. CHAPMAN, engineering specialist of New York City and representative of the American Society of Mechanical Engineers.

Among the members of the executive committee which will serve under Mr. Serrill are J. C. Parker and C. E. Skinner, representing the American Institute of Electrical Engineers; S. G. Rhodes, representing the electric light and power group, and S. L. Nicholson, representing the National Electrical Manufacturers' Association.

OWEN D. YOUNG, chairman of the board of directors of the General Electric Company, returned from abroad April 30 on the *Leviathan* after a short sojourn in Europe.

FRANK L. DAME, president of the North American Company, was elected a member of the board of directors of the Bank of America National Association April 30 at the first meeting of the enlarged institution formed by the merger of the Bank of America, the Bowery & East River National Bank and the Commercial Exchange Bank.

M. O. Troy Named Manager of Central-Station Department

Matthew O. Troy has been appointed manager of the central-station department of the General Electric Company, Schenectady, according to an announcement made by President Gerard Swope. Mr. Troy has been identified with the General Electric Company continuously since 1897, when, following graduation from the University of Virginia, he entered the testing department at Schenectady.

He was later transferred to Lynn as foreman of transformer test and in 1898 he became associated with Elihu Thomson and Richard Fleming in pioneer work on constant-current transformers. In 1901 Mr. Troy was made assistant engineer of the Lynn alternating-current engineering department, subsequently entering the transformer sales department. In 1907 he became manager of sales of transformers, lightning arresters and regulators and in 1923, when the lighting department became the central-station department, Mr. Troy was named executive assistant manager. Mr. Troy has been a leader in the Pittsfield and Schenectady sections of the American Institute of Electrical Engineers and has been active in committee work in the National Electric Light Association and is a member of the board of governors of the National Electrical Manufacturers' Association.

M. O. Troy

C. W. Stone Becomes Consulting Engineer in Schenectady

C. W. Stone, manager of the central-station department of the General Electric Company, Schenectady, since its formation, has been appointed to the position of consulting engineer, having requested that he be relieved of his former responsibilities. As consulting engineer he will advise and assist in all new engineering developments for the General Electric Company and will also continue to act as consulting engineer for the R. C. A. Photophone, Inc.

Following graduation from the University of Kansas, Mr. Stone joined the Franklin Electric Company of Kansas City in 1894. Subsequently he was connected with the W. S. Hill Electric Company of New Bedford, Mass., and the Hancock Equipment Company of Boston before entering the drafting department of the General Electric Company. He held many important assignments in the engineering department and on the death of C. D. Haskins was made manager of the lighting department. In 1923 the lighting department was designated the central-station department and Mr. Stone continued as its manager. Mr. Stone has been active in the affairs of the National Electric Light Association, the American Institute of Electrical Engineers and the Association of Edison Illuminating Companies and is, in addition, a member of the American Society of Mechanical Engineers, the Illuminating Engineering Society, the Franklin Institute and other technical organizations.

Miss Zillessen Made Advertising Manager

Clara H. Zillessen has been appointed advertising manager of the Philadelphia Electric Company after an affiliation with that utility which covers a period of fourteen years. Miss Zillessen was born in New York City and was educated there and in New Jersey. With the exception of two years as a fashion correspondent in New York her entire business life has been spent in the electrical industry. She started advertising work for the Philadelphia Electric Company in 1914 as a copy writer and in 1922 she was made assistant advertising manager. In addition to her executive duties with the Philadelphia utility, Miss Zillessen has developed broadening outside interests. She is chairman of the women's committee of the Pennsylvania Electric Association, a member of the Illuminating Engineering Society and of the Women Writers' Club. She has contributed numerous articles to newspapers and magazines and was the first winner of the Walter H. Johnson prize, awarded annually through the Pennsylvania Electric Association for the most constructive paper on central-station operation. The announcement of Miss Zillessen's appointment was made by William H. Taylor, president.

Miss C. H. Zillessen

THEODORE BERAN, who retired May 1 as commercial vice-president of the General Electric Company, as announced in the April 28 issue of the ELECTRICAL WORLD, was tendered a testimonial banquet on the evening of May 2 at the Plaza Hotel, New York, by his former associates. The toastmaster of the occasion was Vice-President J. R. Lovejoy, and Gerard Swope, president, spoke on behalf of the company. On this occasion Mr. Beran was presented with a beautifully engraved tray by his associates. He is sailing on Saturday on the U.S.S. *Leviathan* for an extended trip through Europe.

E. J. CONDON, JR., has terminated his connection as vice-president of the General Power & Light Company, the Arizona Edison Company and the Northern Michigan Public Service Company to engage in consulting engineering work with offices in Chicago. A graduate of Armour Institute, Mr. Condon has gained wide electrical experience in the course of his engineering career. As executive in charge of operation and management he developed successfully several central station properties in the Mountain Region and in the Middle West.

Obituary

JAMES A. SKINNER, who was connected with the General Electric Company for 30 years, died at his home in East Orange, N. J., April 16, after a long illness. During the war Mr. Skinner was supervisor of industrial relations and the manager's representative on the co-operative committee for the General Electric Company.

WILLIAM CARROLL, some years ago city electrician of Chicago, died at his summer home in Hartford, Mich., April 19, in his 77th year. Mr. Carroll retired from public office in 1912 after spending 38 years in city service, during seven of which he was city electrician. He was self-taught in technical matters, but his practical experience in the electrical work of the city made his services valuable and enabled him to conduct successfully the work of an important department through varying political administrations.

EDWIN HULLEY, president of the Hulley Electric Company, Philadelphia, died suddenly at his home in that city April 23. Mr. Hulley, who was 47 years of age, was born in Philadelphia and was affiliated with the Philadelphia Electric Company for 22 years. He was a district manager when he resigned to establish the company that bears his name. Mr. Hulley was very active in civic affairs.

Financial and Statistical News

Money Rates No Check Prices Rise en Masse

THE feature of significance in connection with the rise of call money to 6 per cent early this week was its ineffectiveness as a check upon speculative activity. Of course the increase was related closely to month-end payments, and an abundance of funds was immediately attracted from interior banks. But it is interesting to note that the 6 per cent rate had practically no restrictive effect just as the advance in Federal Reserve rates in certain districts was apparently ineffective. A complete revision of theory concerning the relation between money rates and speculative activity in the markets may soon be required.

The public utility stocks were in the limelight among the issues which advanced in the face of higher money rates. Power and light common stocks advanced this week in virtually all markets, and the gains have been well sustained. The present behavior of these issues supports the theory that the utility stocks have been considerably behind the market and are now advancing into a more proper alignment in relation to the market as a whole.

Among the more active issues this week Brooklyn Edison was again prominent, advancing twelve points, to 262; Consolidated of Baltimore gained eleven points, to 93; Edison of Boston advanced seven points, to 283; Metropolitan Edison five points, to 165; Middle West Utilities eleven points, to 152, and Southeastern Power & Light eight points, to 60. In addition there were a great many gains of from two to five points.

Prospects of dividend action in Radio Corporation common are increased by a statement attributed to President James G. Harbord that a dividend cannot reasonably be delayed much longer. It is probable that the matter will be taken up this week when the preferred dividend is being discussed.

Loewenstein May Acquire Interest in Our Utilities

Apart from his interest in the development of hydro-electric power in the United States and Canada, nothing of unusual significance attaches to the recent visit to this country of Alfred Loewenstein, Belgian banker and financier. When interviewed with regard to the purpose of his visit, Mr. Loewenstein stated that he was interested in introducing the shares of the International Holding & Investment Company, a Canadian investment institution, into the New York market, and might possibly be in the market for certain utility stocks or properties.

Mr. Loewenstein denied the rumor that he intended to purchase control of the Brazilian Traction, Light & Power Company, adding that he was merely acting in an informal way to safeguard the interests of a group of bondholders of one of the company's subsidiaries.

February Operations Show 8.1 per Cent Advance

FEBRUARY earnings of the electric light and power industry exceeded those of the corresponding month last year by 8.1 per cent, according to monthly reports received by the ELECTRICAL WORLD, and indicate a total for the country of $163,400,000. The rate of increase is materially larger than that of January, which, according to revised figures, amounted to 6.7 per cent, but against this must be balanced the fact that February this year had an extra day. Operating expenses, $64,200,000, also rose, but by only 6.7 per cent, this item being much less affected by the length of the month. Energy output was 6,390,701,000 kw.-hr., 12.0 per cent more than a year ago; 38.3 per cent came from water power and 61.7 per cent from fuel, the actual amounts being 2,445,189,000 and 3,945,512,000 kw.-hr. respectively, and the corresponding increases 12.5 and 11.6 per cent. As heretofore, the increasing efficiency in the use of fuel continues; the 11.6 per cent increase in output from fuels was attained with a 6 per cent increase in coal consumption, the 27 per cent increase in gas being roughly though not completely balanced by a 25.5 per cent decrease in fuel oil. In terms of coal equivalent, oil has fallen behind gas in importance.

In daily averages the month's operations broke all previous records; the revenue, $5,630,000, was higher than the average daily revenue for January, $5,560,000, which was the highest until that time; the output, slightly over 220,000,000 kw.-hr., passed the daily average for December, the previous highest, which was a little less than 217,000,000 kw.-hr., and coincides almost exactly with the estimated normal, 220,200,000,

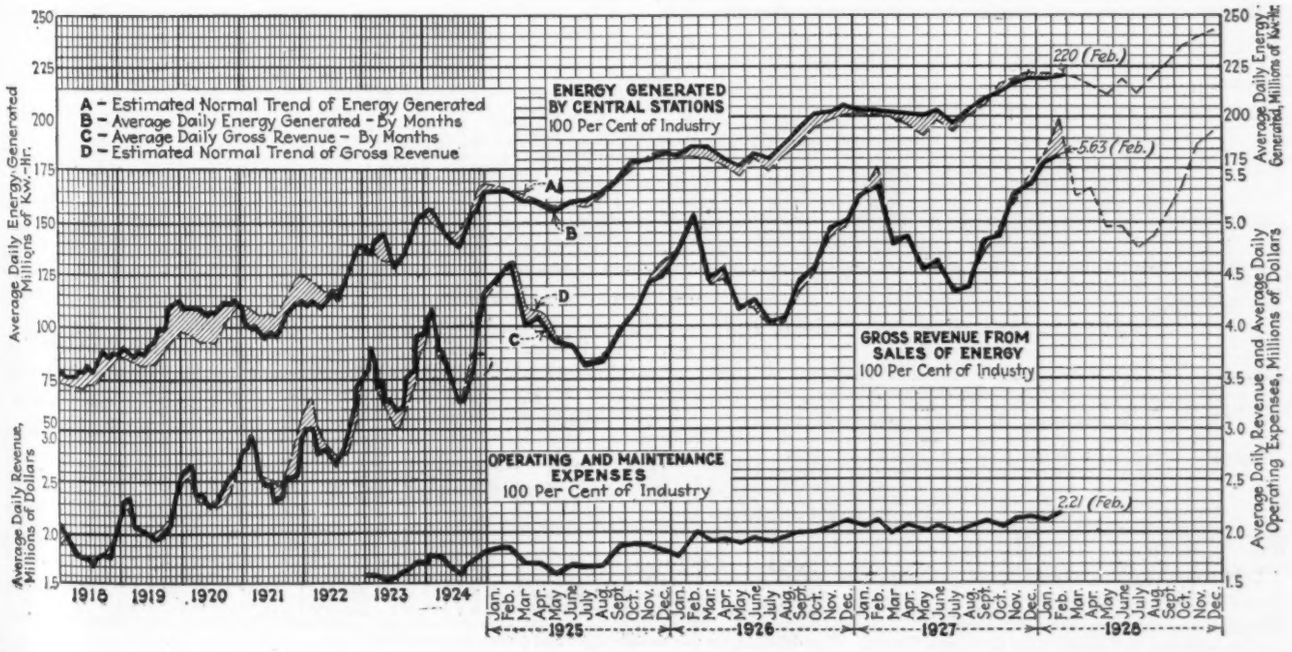

A – Estimated Normal Trend of Energy Generated
B – Average Daily Energy Generated – By Months
C – Average Daily Gross Revenue – By Months
D – Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALES OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
220 (Feb.)
5.63 (Feb.)
2.21 (Feb.)
Average Daily Energy Generated, Millions of Kw.-Hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
1918 1919 1920 1921 1922 1923 1924
1925 1926 1927 1928

Table I—Generation and Distribution of Central-Station Energy in the United States

(100 Per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1927 Thousands	1926 Thousands	Per Cent Inc.	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands
Nov..	6,517,713	6,063,784	+ 7.5	5,365,713	4,990,784	1,400,000	7,310,000	3,406,713	3,129,784	559,000	551,000	1,152,000	1,073,000	1,269,000	1,187,000
Dec...	6,811,347	6,375,500	+ 6.8	5,605,347	5,247,500	1,500,000	1,400,000	3,475,347	3,226,500	630,000	621,000	1,206,000	1,128,000	1,220,000	1,120,000
	1928	1927		1928	1927	1928	1927	1928	1927	1928	1927	1928	1927	1928	1927
Jan...	6,764,728	†6,303,199	†+7.3	5,579,728	5,188,199	1,493,000	1,395,000	3,511,728	3,170,199	575,000	623,000	1,185,000	1,115,000	1,315,000	1,148,000
Feb...	6,390,701	†5,706,468	†+12.0	5,260,701	4,696,468	1,395,000	1,210,000	3,355,701	2,928,468	510,000	558,000	1,130,000	1,010,000	1,300,000	1,085,000

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.
†1928 figures are only approximately comparable with those for 1927, because of changes in classification of certain plants.

based on past growth and observed seasonal variations. The average daily revenue, is, as in other recent months, somewhat below the normal, computed at $5,988,000. It is somewhat difficult to say how great is the effect, on this average, of the extra day. Operating expenses, averaging $2,210,000 a day, also reached a new maximum, but by only a small margin.

Regional analysis reveals averages not varying widely from the national, except in the South Central States where the returns indicate that the revenues exceeded those of February, 1927, by about 11 per cent. Similarly the regional averages of increase in energy output show somewhat less than the usual variation, the Southwest ranking highest, the South Atlantic Division lowest, with the others fairly close to the average for the country as a whole.

The purchase of energy for resale fluctuates more irregularly than does energy output or revenue, but in general is gradually rising. For several months it has been not far from 1,300,000,000, and that figure was again reached in February.

Electric Supply in New Zealand

Of the electric supply in New Zealand 74.53 per cent is hydro, 23.20 per cent is steam, 1.42 gas and 0.88 oil, according to a recent letter from Charles Dash, chairman of the New Zealand Electric Power Board Secretaries Committee.

The water power that is available vastly exceeds the needs of the present population of 1,440,000, being estimated by government engineers at 4,887,030 hp., or 3.4 hp. per capita. Energy output in 1927 was equivalent to 310 kw.-hr. per capita; the power load is fast increasing in importance so that the peak demand now generally comes on the industrial load; in addition, 7 per cent of the customers cook by electricity. In dairying, milking machines increased from 1,310 in 1923 to 6,738 in 1927, though 9,000 machines are still fuel-driven. Other items are:

Capital investment approximates 19,000,000 ($92,000,000), made up of 7,000,000 government, 8,250,000 local bodies connected with government supply and 3,750,000 local bodies not connected with government supply; distribution line miles, 15,000; consumers, 228,000.

Electric Power in Oil Fields

The use of electrically driven equipment in the oil fields has been found effective in each of the three most important operations in the industry, namely, production, pipe line pumping and refining. On the lines of the Oklahoma Gas & Electric Company this type of load has increased at a remarkable rate, according to data recently published by the company. Beginning with a contract covering a 30-hp. motor at the end of 1919, the energy sales to oil fields have grown as shown in the table above.

1920	829,088
1921	1,502,565
1922	2,689,457
1923	6,134,607
1924	9,432,290
1925	13,192,512
1926	32,239,937
1927	158,730,509

Table II—Central-Station Financial Operations for Four Months in the United States

(100 Per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1927 Thousands	1926 Thousands	Per Cent Inc.	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands	1927 Thousands	1926 Thousands
Nov.....	$158,200	$148,300	+6.7	$94,300	$89,100	$47,400	$43,200	$5,000	$4,900	$11,500	$11,100	$64,300	$62,450
Dec.....	165,100	155,000	+6.5	95,900	90,800	52,200	48,100	5,200	5,000	11,800	11,100	67,900	63,200
	1928	1927		1928	1927	1928	1927	1928	1927	1928	1927	1928	1927
Jan.....	171,900	161,100	+6.7	101,500	95,400	53,400	49,300	5,700	5,600	11,300	10,800	66,100	63,400
Feb.....	163,400	151,100	+8.1	96,100	89,800	50,700	45,700	5,200	5,400	11,400	10,200	64,200	60,200

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

*Table III—Operations of Central-Station Hydro and Fuel Plants in the United States**

(100 Per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro-Plants			Fuel Power Plants			Coal			Oil			Gas		
	1927 Thousands of Kw.-Hr.	1926 Thousands of Kw.-Hr.	Per Cent Increase	1927 Thousands of Kw.-Hr.	1926 Thousands of Kw.-Hr.	Per Cent Increase	1927 Short Tons	1926 Short Tons	Per Cent Increase	1927 Barrels	1926 Barrels	Per Cent Increase	1927 Thousands of Cubic Feet	1926 Thousands of Cubic Feet	Per Cent Increase
Nov.....	2,466,092	2,193,093	+12.5	4,051,621	3,870,691	+ 4.7	3,236,107	3,193,212	+1.3	484,261	926,916	—47.5	5,630,302	3,975,408	+41.6
Dec.....	2,697,770	2,377,175	+13.5	4,113,577	3,998,325	+ 2.9	3,340,137	3,406,140	—1.9	624,276	769,518	—18.9	4,805,064	3,685,611	+30.4
	1928	1927		1928	1927		1928	1927		1928	1927		1928	1927	
Jan.....	2,607,379	2,331,140	+11.9	4,157,349	3,972,059	+ 4.6	3,333,658	3,365,461	—1.0	559,914	786,062	—28.8	4,955,906	3,900,868	+27.0
Feb.....	2,445,189	2,172,740	+12.5	3,945,512	3,533,728	+11.6	3,135,123	2,958,797	+6.0	515,488	646,558	—20.3	4,899,747	3,859,791	+27.0

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

Electric Bond & Share Shows Larger Surplus

THE fact that both gross and net income of the Electric Bond & Share Company declined last year is due to the absence of certain substantial items of income, of a non-recurring nature prominent in 1925 and 1926, and also a decline in the volume of securities sold and construction work done for associated companies. Gross income fell off 7.6 per cent, to $18,513,299, and net income declined 15.4 per cent, to $11,899,326. The surplus at the close of December amounted to $21,039,062, having been increased from $16,766,140 due to reappraisement of securities and accounts and premium on sale of preferred stock, etc. Income figures for the past two years are shown in the accompanying table.

According to its annual statement the Electric Bond & Share Company anticipates a gradual shifting in the relative importance of some of the principal sources of income, the result of which should be better to stabilize the company's business and income. The rate of increase in the gross income derived from supervisory services rendered associated companies is expected to be less than heretofore, while the return on securities owned should become a much more important factor. One feature of interest in this connection is that the securities of the companies now associated with the Electric Bond & Share Company have become so well regarded by the investing public that the company is able to render the service of negotiating and selling these securities to investment bankers and others under a lower schedule of commissions.

Total assets of the company as of Dec. 31, 1927, amounted to $124,195,442, but the market value is materially greater than the book value.

INCOME STATEMENT

	1926	1927
Gross income	$20,056,694	$18,513,299
Net income	14,069,234	11,899,326
Preferred dividends	1,500,000	2,376,933
Balance	12,569,234	9,522,393
Common dividends	2,000,000	*27,137,500
Accumulated income	33,940,648	16,325,541

* Includes special dividend on common stock in addition to the regular 8 per cent.

Four New Issues Offered

Five-year 4½ per cent gold coupon notes of the Columbus Electric & Power Company were offered during the week ended May 3 to the amount of $2,500,000, the price being 97.80 and interest, to yield 5 per cent.

The Gulf States Utilities Company issued 30,000 shares of $5.50 dividend preferred stock at 98 and accrued dividend. Proceeds derived from the sale of these securities will be used to liquidate the floating debt of the company.

A Canadian issue appeared among the new offerings—the three-and-a-half million-dollar loan floated by the Nova Scotia Light & Power Company, Ltd. This issue was in the form of 5 per cent first mortgage 30-year sinking fund gold bonds, series A.

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday May 1	Low 1928	High 1928
ABITIBI PWR. & PAPER, com., new — no par	81	72	85
Ala. Pwr., $7 cum. pf.—no par	k115½	114½	115½
Allis Chalmers Mfg.,6% com.,ex.div.	127	115½	129½
Aluminum Co. of Amer., com.	149½	120	150½
Aluminum Co. of Amer., 6% pf.	109½	105½	109½
Amer & Foreign Pwr., 7% pf.—no par	109	105½	109
Amer. & Foreign Pwr., com.—no par	38'	22½	38½
Amer. Bosch Magneto, com.—no par	24½	15½	28½
Amer. Brown Boveri Elec.†	12½	10	18
Amer. Brown Boveri Elec., pf. $7	45	40½	63
Amer. Gas & Elec., 6% pf.—no par	109½	106½	109½
Amer. Gas & Elec., com. †—no par	150	117½	154
Amer. Lt. & Trac., 6% pf.	115	116	120
Amer. Lt. & Trac., new com.	219	170	220
Amer. Pwr. & Lt., 6% pf.	108	104	109½
Amer. Pwr. & Lt., com. †—no par	86½	62½	87
Amer. Pub. Serv., 7% pf.	a100½	97½	101
Amer. Pub. Serv., com. †	k 70	70	75
Amer. Pub. Utilities, 7% pfc. pf.	a 96½	87½	97
Amer. Pub. Utilities, 7% pr. pf.	101	94	101
Amer. Pub. Utilities, com.	k 60	60	65
Amer. States Sec., A	a 11	4	12½
Amer. States Sec., B	a 16½	4½	16½
Amer. Superpwr., 6% 1st pf.	l 102½	....	....
Amer.Super pwr., Class A†—no par	55½	37	56
Amer.Super pwr., Class B†—no par	56½	37½	56½
Amer. Wtr. Wks. & Elec., 6% pf.	k105	101½	106
Amer. W.W. & E., com. new—no par ex.div.	70	52½	70
Anaconda Copper cap. $3	70½	53½	72½
Appalachian Electric Pwr., 7% pf.	109	108½	110
Arkansas Pwr., & Lt. 7% pf	108	107½	111
Assoc. Gas & Elec., $3.50—50	54½	....	....
Assoc. Gas & Elec., pf.—$6—no par.	96	96	98½
Assoc. G. & E., Class A, 10—no par.	48½	47	51½
BABCOCK & WILCOX, 7% com.	123½	117½	124½
Binghamton L. H. & P., $6 pf.	108	102	109½
Birmingham Elec., pf.—$6—no par	106	104	107
Blackstone Valley G. & E., 6% pf.	k106	106	112
Blackstone Valley Gas & Elec., 10% com.—50	k165	135	170
Blaw-Knox, com.†	101	91	105
Brazilian Trac., Lt. & Pwr., $7 com.	f246	....	....
Brazilian Trac., Lt. & Pwr.,com.,new	f 62	....	....
Broad River Pwr., 7% pf.	105	105	108½
Brooklyn Edison, 8% com.	262	206½	268½
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	l 26½	....	..
Buffalo, Niagara & East. Pwr. com. $1.20—no par	l 42½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	99	98	101
California Ry. & Pwr., 7% pf.	135	....	....
Carolina Pwr. & Lt., pf.—$7—no par	l111½	109	110½
Central & S. W. Util., $7 pf.—no par	a104½	99½	105½
Central & S. W. Util., pr. ln. $7 pf.—no par	a109	103½	110
Central Ark. Ry. & Lt., 7% pf.	106	105	107½
Central Ill. Pub. Serv., $6 pf.	a 99½	95	100
Central Ind. Pwr., 7% pf.	a100	....	....
Central Maine Power, 6% pf.	98	96	98½
Central Maine Power, 7%	110	109	112
Central Pwr. & Lt., 7% pf.	k109½	104½	110
Central States Elec., 7% pf.	k116	104	118
Cincinnati Gas & Elec., 5% com.	g100½	97½	100½
Cities Service, $6 pf.—no par	l 103½	94½	103
Cities Service, pf. B—no par	l 9½	8	9½
Cities Service, pf. BB—no par	l 97	88½	97
Cities Service com.—20	l 62½	59½	61½
Cities Service, Bks. Shrs.—10	30½	26½	30½
Cities Service Pwr. & Lt., 7% pf.	108½	105½	109
Cities Service Pwr. & Lt., 6% pf.	100½	95½	101½
Cleveland Elec. Illg., 6% pf.	113	113	115½
Cleveland Elec. Illg., 10% com.	415	350	425
Columbia Gas & Elec., 6% pf.	109	107½	110½
Columbia G. & E. com. $5—no par	104½	89½	106½
Columbus Elec. & Pwr., $2 com.—no par	79	64	79
Columbus Elec. & Pwr., 7%	112	....	....
Columbus Ry., Pwr. & Lt., 7%	109½	....	....
Columbus Ry., Pwr. & Lt., 7% pf. B	109½	....	....
Columbus Ry., P.& I t. com. no par	120	120	125
Commonwealth Edison, 8% com.	a184	165	189
Commonwealth Pwr., 6% pf.	103½	102½	104½
Commonw'th Pwr., $2, com.—no par	86½	62½	86½
Conn. Lt. & Pwr., 8% pf.	121	120	123
Conn. Lt. & Pwr., 7% pf.	117	118	121
Cons. Gas of N. Y., pf.	104½	101½	105
Cons. Gas of N. Y., com. $5—no par.	165½	119½	167½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	e111½	110	113
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	m111½	110½	114½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf.	e105½	100½	105½
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par	a 92½	67½	92½
Consolidated Pwr. & Lt., 7% pf.	105	....	....
Consumers Pwr., 6% pf.	104½	106	107
Consumers Pwr., 6.6% pf.	105	106	107
Continental Gas & Elec., 7% pr. pf.	108	106½	108½
Conti. G. & E. com. $4.40—no par.	k230	240	265
Crocker Wheeler, com.†	44	23	46
Crocker Wheeler, 7% pf.	93	77	95
DALLAS PWR. & LT., 7% pf.	110	110	111½
Dayton Pwr. & Lt., 6% pf.	109	108½	110½
Derby Gas & Elec., 7% pf.	102	96	100½
Detroit Edison, 8% com.	190½	166½	194½
Dubilier Condenser, com.—no par.	3½	2½	5½
Duke Pwr., cap.	k138	130	145
Duquesne Lt., 5% pf.	105½	104½	105½
EASTERN NEW YORK UTIL., $7 pf.	k110½	111	112½
Eastern States Pwr. B	k 21½	11½	22½
Eastern States Pwr., pf	k 99½	98	100½
East. Tex. Elec., 7% pf.	107½	106	109
Edison Elec.of Boston, $12 com.	d283	252	284½
El Paso Elec. 7% pf.	110	110	112½
Elec. Bond & Share, 6% pf.	l110½	108½	111½
Elec. Bd. & Sh. Sec., com. $1—no par ex. rights	l120	76	127½
Electric Household Util.†	a 21½	13½	24
Elec. Investors, 6% pf.—no par.	103½	101	104½
Elec. Investors, com.†—no par.	59½	40½	60½
Elec. Pwr. & Lt., ctfs. pf.	109½	106½	110½
Elec. Pwr. & Lt., ctfs., 40% pd.	m127	120½	129½
Elec. Pwr. & Lt., ctfs., com.—no par	44½	28½	44½
Elec. Ry. Securities, com.—no par.	6½	....	....
Elec. St. Battery com. $5.25—no par	83	69	83½
Elmira Wtr., Lt. & R.R., 7% pf.	106½	104	107
Empire Pwr., pfc.†	33½	30	35½
Engr. Pub. Serv. $7, pf.—no par.	110½	107	110½
Engr. Pub. Serv., com.—no par.	40½	33	42½
Eureka Vacuum Cleaner, com. $4—no par.	75½	69	79
FAIRBANKS MORSE, 7% pf.	k110	104	110
F.-M., com.—$3—no par	51½	32½	54
Federal Lt. & Trac.,com $1.40	56½	42	56½
Federal Lt. & Trac. $6 pf.—no par.	107½	98	109
Florida Pwr. & Lt., 7% pf.	k108	105	108
Ft. Worth Pwr. & Lt., 7% pf.	l114	113	114½
GALVESTON-HOUSTON ELEC. 6% pf.	82	75	85
Galveston-Houston Elec., com.	36	31	34
General Cable, Cl.A	77	56	84½
Gen. Elec. $3 com.—no par.	164½	124	174½
Gen. Elec., special—6%	11½	11½	11½
Gen. Gas & Elec. (Del.) com A $1.50—no par.	47½	35½	48½
Gen. G. & E. (Del.) pf. A $8—no par	130	125	144
Gen. G. & E. (Del.) pf. A $7—no par.	122	110	120
Gen. G. & E. (Del.) pf. B $7	114	105½	114
Gen. Pub. Serv., $7 cum. pf., no par.	k117	110	120
Gen. Pub. Serv., com., no par.	24½	16½	24½
General Public Utilities, $7 pf.	k100½	98	101
Ga. Lt., Pwr. & Rys., com.	k 58	55	65
Gt. Western Pwr., 7% pf.	k105	....	....
IDAHO PWR., 7% pf.	110	109	111½
Ill. No. Utilities, 6% pf.	a100½	98½	100½
Ill. Pwr. & Lt., 7% pf.	106	103	107
Indianapolis Pwr. & Lt., 6¼% pf.	105½	102	107½
Indianapolis Pwr. & Lt., $7 pf.	101½	100	105
Ingersoll Rand com.	k 97½	90	98
Int. Combus. Engr., com. $2—no par	53½	45½	55½
Int. Combustion Engr.,7% pf.	104½	103	105½
Int. Util., Class A—$3.50—no par.	48½	44½	51½
Int. Utilities, Class B—no par.	13½	6½	13½
Interstate Pwr., pf.—$7—no par.	103	99	103½
Interstate Pub. Serv., 7% pf.	105	103	106½
Iowa Ry. & Lt., 7% pf.	101	.02	103
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	108	105	107
Johns-Manville, com.†—no par.	129½	111½	133½
Johns-Manville, 7% pf.	m122½	119½	121½

Stock Exchange: cChicago; δSt. Louis; ePhiladelphia; dBoston; eBaltimore; f Montreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, April 28. lBid price Wednesday, May 2. mLatest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday May 1	Low 1928	High 1928
KANSAS GAS & ELEC. 7% pf.	*l*110	107	110
Kelvinator Corp.	21	11¼	22½
Kentucky Hydro-Elec., 7% pf.	*a*104½	102	104½
Kentucky Sec., 6% pf.	95	94	98
Kentucky Sec., 5% com.	150	140	150
Kentucky Utilities, 6% pf.	104½	100	105
LACLEDE GAS LT., 10% com.	*k*200	200	260
Lehigh Pwr. Sec., com.—no par	34	19¾	34
Long Island Ltg., 7% pf.	*k*110½	110½	112½
Long Island Ltg., 6% pf.	*k*109	107	109
Long Island Ltg., com.†—no par	*k*177	170	185
Los Angeles Gas & Elec., 6% pf.	*h*112¾	105½	112½
Louisville Gas & Elec., cl. A $1.75	36½	28	37½
MAN. ELEC. SUPPLY, cap. $5—no par	53½	50	61
Maytag Co., com. 50—no par	38½	30	40½
Memphis P. & L., pf.—$7—no par	110	109	111
Metropolitan Ed., pf.—$6—no par	109	103	109½
Metropolitan Ed., pf.—$7—no par	109½	109	111
Metropolitan Ed., com. $5—no par	*k*165	125	155
Middle West Utilities, 6% pf.	*a*100	93½	100
Middle West Util., 6% pr. lien	*a*106½	99	107
Middle West Util., com. $6—no par	*a*151½	123½	151½
Midland Utilities, pr. in. 6% pf.	*a* 95	94½	97
Midland Utilities, 6% pf. A	*a* 90½	89½	92½
Milwaukee Elec. Ry. & Lt., 7% pf.	105	100	106
Milwaukee Elec. Ry. & Lt., 6% pf.	100	98	110
Minn. Pwr. & Lt., 7% pf.	*l*108½	107	109
Miss. River Pwr., 6% pf.	*k*108	94	109½
Miss. River Pwr., 3% com.	110	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	109½	107½	110
Mohawk Hudson Pwr., 2d pf.—$7—no par	106	105	108½
Mohawk Hudson Pwr., com.—no par	41½	29½	41½
Montana Pwr., 5% com.	166½	102½	169½
Montreal Pwr., 7% com.	*f*103	....	....
Mountain States Pwr., 7% pf.	*k*103½	97	105
Mountain States Pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	110½	98	110½
National Carbon, 8% pf.	*a*136½	136½	139½
National Elec. Pwr., A †	*a* 30½	27½	32½
National Lt., Ht. & Pwr., com.	*k* 24	20	30
National, Light, Ht. & Pwr., 5% pf.	72	70	80
National Pwr. & Lt., pf.—$6—no par	*k*105½	102	106
National Pwr. & Lt., com.†—no par.	34½	21½	34½
National Pub. Serv., 7% pf.	102½	99	103
National Pub. Serv., 7% pfc., pf.	114	....	....
National Pub. Serv., A com. $1.60—no par	25½	22	27½
National Pub. Serv., B com.—no par	*k* 27½	24½	30
Nebraska Pwr., 7% pf.	*m*110	110	111½
Nevada-Calif. Elec., com.	33	22	37
New Brunswick Pwr., 4% pf.	63	60	70
New Eng. Pub. Serv., pr. in. pf. $7	111	98½	110½
New Eng. Pub. Serv., pf. $7	107	95	108
New Orleans Pub. Serv.—7% pf.	108	106	110
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	100	91	100
N. Y. Central Elec., 7% pf.	105	101	105½
New York Power & Light 7% pf.	114½	....	....
Niagara Falls Pwr., 7% pf.—25	27½	27½	28½
No. Amer., 6% pf.—50	54½	53½	55½
No. Amer., com.—10	71½	58½	71½
No. Amer. Edison, $6 pf.—no par	103½	102	105½
Northeastern Pwr., com.	28½	19½	30
No. N. Y. Utilities, 7% pf.	109	103	109
No. Ohio Pwr., com.—no par	27½	18	28
Northern Ohio Pwr. & Lt., 6% pf.	100	90	99
No. Ont. Lt. & Pr. 6% pf.	*k* 99½	94	100
No. Ont. Lt. & Pwr., 4% com.	*k* 72	73	78
No. States Pwr. (Del.), 7% pf.	109	101	110
No. States Pwr. (Del.), 8% com.	147½	123	149½
No. Texas Elec., 6% pf.	54½	45	70
No. Texas Elec., com.	17	....	....
OHIO BRASS, com. B $4—no par.	*k* 96½	89	100½
Ohio Brass, 6% pf.	*k*105	106	111
Ohio Pwr., 6% pf.	109	104	109½
Ohio Pub. Serv., $6 pf.	103	95	105
Ohio Pub. Serv., 7% pf.	113	107	112
Ohio River Edison, 7% pf.	109	106	109½
Oklahoma Gas & Elec., 7% pf.	114½	106	115½
PACIFIC Gas & ELEC., 6% pf.	*k* 28½	25½	29
Pacific Gas & Elec., 8% new com.	53	43½	53
Pacific Pwr. & Lt., 7% pf.	*l*110	106	110
Penn Cent. Lt. & Pwr., $5 pf.—no par	*c* 81	79½	82
Penn-Ohio Edison, 6% pf. no par	99	93½	99
Penn-Ohio Edison, 7% pf.	106½	106½	109
Penn-Ohio Pwr. & Lt., 7% pf.	111	....	....
Penn Pwr. & Lt.—$7—no par.	*l*109½	109½	110½
Penn Wtr. & Pwr., $2.50 com., new	*e* 88½	68	88½
Phila. Co., 5% pf.—50	*k* 46½	45½	48½
Phila. Co., 6% pf.—50	56½	52	57
Phila. Co., com.—50	*k*155	145	166
Phila. Elec., 8% com.—25	*c* 68½	55½	68½
Portland Elec. Pwr., 7% pf.	103½	100	104½
Portland Elec. Pwr., 6% pf.	95	78	96
Portland Elec. Pwr., 6% 2d pf.	83	55	88
Portland Elec. Pwr., com.	43	....	....
Potomac Elec. Power, 6% pf.	*f*113½	....	....
Pwr. Sec., pf.—no par	60	50	68
Pwr. Sec., com.—no par	12	11	13½
Public Serv. of Colorado, 7% pf.,	105	....	....
Pub. Serv. of N. J., 6% pf.	111½	103½	112
Pub. Serv. of N. J., 7% pf.	*k*126	118	126
Pub. Serv. of N. J., $2 com.—no par	57½	41½	58
Pub. Serv. of No. Ill., 6% pf.	*a*113	110	115
P. S. of No. Ill., com. $8—no par	*a*180	159½	180
Pub. Serv. of No. Ill., $8 com.	*a*179	159½	180
Pub. Serv. of Okla., 7% pr. in.	106	100	107
Pub. Serv. Elec. & Gas, 6% pf.	*k*110	108	110½
Puget Sound Pwr. & Lt., 7% pf.	*k*110	105	109
Puget Sound Pwr. & Lt., $6 pf.—no par	104½	92	105½
Puget Sound Pwr. & Lt., com.	80	34½	84½
RADIO CORP. OF AMER., $3.50 pf.—50	56	54½	57½
Radio Corp. of Amer., com.—no par.	181½	85½	196½
Rochester Gas & Elec. 6% pf. D.	106	105½	106½
Rochester Gas & Elec., 7% pf. B.	107½	105	107
Rochester Gas & Elec., 6% pf. C.	105½	105½	106½
SAN JOAQUIN Lt. & Pwr., 7% pr. pf.	114	110	117½
St. Joseph Ry., L., H. & P., 5% pf.	*k* 75	70	75
Servel, Inc.	9½	4½	10½
Sierra Pacific Elec., 2% com.	38½	29	38½
Sioux City Gas & Elec., 7% pf.	107½	100	108½
Southeastern Pwr. & Lt., pf.—$7—no par	*j* 109½	....	....
Southeastern Pwr. & Lt., ptc. pf.	*j* 90½	....	....
Southeastern Pwr. & Lt., com.—no par	59½	40½	61
So. Calif. Edison, 8% pf.	49	38½	41
So. Calif. Edison, 7% pf.	29	27½	29½
So. Calif. Edison, 6% pf.	26	25½	28
So. Calif. Edison, 8% com.	48½	43½	49½
Southern Cities Utilities, 7% pf.	81½	75	87
Southwestern Lt. & Pwr., A $3	80	60	80
Southwestern Lt. & Pwr., B	65	60	65
Southwestern Lt. & Pwr., $6 pf.	94	88	96½
Southwestern Pwr. & Lt., 7% pf.	*k*113½	103	115
Standard Gas & Elec., 8% pf.	70½	65	71
Standard Gas & Elec., 7% pr. pf.	114	108	115
Standard G. & E., com. $3.50	70½	57½	70½
Standard Power & Light, com.	43½	29½	45
Standard Pwr. & Lt., 7% pf.	*k*105½	98	106
Staten Island Edison, pf.—$6—no par	102½	99	103½
Superheater, $6 com.—no par	158	155	178
Syracuse Lighting, 7% pf.	110	103	112½
Syracuse Lighting, 8% pf.	*k*117½	114	119
TAMPA ELEC., com. $2	68	62	69½
Tenn. Elec. Pwr., 6% pf.	103½	92	103
Tenn. Elec. Pwr., 7% pf.	109	107	110
Terre Haute, Ind. & East. Trac., 5% pf.	*k* 10	....	....
Terre Haute, Ind. & East. Trac., com.	*k* 1	1	3
Tex. Pwr. & Lt., 7% pf.	*l*114	113½	115
Tide Water Pwr., 8% pf.	112	108	112
Timken Roller Bear., com.—$4 no par	128½	112½	134
Toledo Edison, 7% pf.	109½	108	111
Toledo Edison, 6% pf.	105	95	105
Toledo Edison, 6% com.	*k*145	120	150
Tri-City Ry. & Lt., 6% pf.	90	88	102
UNITED GAS & ELEC., 7% pf.	95	98	103
United Gas & Elec. (N. J.), 5% pf.	75	70	77
United Gas Impr., 8% com.—50	*c*136½	111½	136½
United Lt. & Pwr., pf.—$4—no par.	*a* 57	53	57
United Lt. & Pwr., pf.—$6.50—no par.	*k*101½	95	101½
United L. & P., com. A 48—no par.	*a* 25	14	25½
United L. & P., com. B 48—no par.	*k* 29	20	29½
Utah Pwr. & Lt., 7% pf.	*l*112½	109½	112
Utica Gas & Elec., 7% pf.	105½	105	106½
Utica Gas & Elec., 8% com.	*k*200	215	225
Utilities Pwr. & Lt., 7% pf.	101	98	103
Utilities Pwr. & Lt., com. A $2	37½	28½	37½
Utilities Pwr. & Lt., com. B $1—no par	29½	18½	30½
VERMONT HYDRO-ELEC., 7% pf.	99	95	102
Virginia Elec. & Pwr., 7% pf.	*k*110½	108	111
Virginia Public Service 7% pf.	102½	97	103½
WAGNER ELEC., 7% pf.	*b*104	96½	104½
Wagner Elec., com.—no par	*b* 78	37	79½
Washington Ry. & Elec., 7% com.	*j*450	....	....
Washington Ry. & Elec., 7% pf.	*j*102	....	....
Washington Wtr. Pwr., 8% com.	225	175	235
West Penn Elec., 7% pf.	113½	109½	115
West Penn Elec., Cl. A $7	110½	106½	112½
West Penn Pwr., 7% pf.	115½	114½	117
West Penn Pwr., 6% pf.	111	108½	113
West Virginia Lt., Ht. & Pwr., 7% pf.	95	94	100
Western Pwr., 7% pf.	105	98	105
Western States Gas & Elec., 7% pf.	*k*102	100	106
Western States Gas & Elec., com.	38	....	....
Westinghouse Elec. & Mfg., 8% com. —50	110	88½	112
Weston Elec. Instrument, Cl. A $2 —no par	*k* 33½	30½	34½
Weston Elec. Instrument, com.—no par	17½	12½	18½
Wheeling Elec., 6% pf.	106	95	109
Worthington Pump, 7% pf. A	58	46½	58½
Worthington Pump, 6% B	50	41	51
Worthington Pump, com.	34½	28	35½
YALE & TOWNE com. $5—25	*k* 80½	68½	84½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid price Saturday, April 28. *l*Bid price Wednesday, May 2. *m*Latest quotations available. †Dividend rate variable.

With the purpose of retiring its 7 per cent issue of cumulative preferred stock the Illinois Power & Light Corporation offered 364,740 shares of $6 cumulative preferred stock at $100 and accrued dividend.

Allis-Chalmers Votes Stock Increase

At the annual meeting held at Wilmington, Del., May 3, the stockholders of the Allis-Chalmers Manufacturing Company voted to increase the authorized stock by $24,000,000, the proposed issue bringing the total authorized stock to $50,000,000. The plan calls for an increase from 260,000 shares of $100 par value to 500,000 shares of $100 par value. It is not contemplated that any portion of the proposed additional authorized capital stock will be issued at this time, but the board of directors deems it advisable to have such unissued stock available for possible requirements in connection with the company's future expansion and development.

Commercial and Municipal Operations in Canada

Compiled from the preliminary report on the census of the Central-Station Industry for 1926, published by the Dominion Bureau of Statistics.

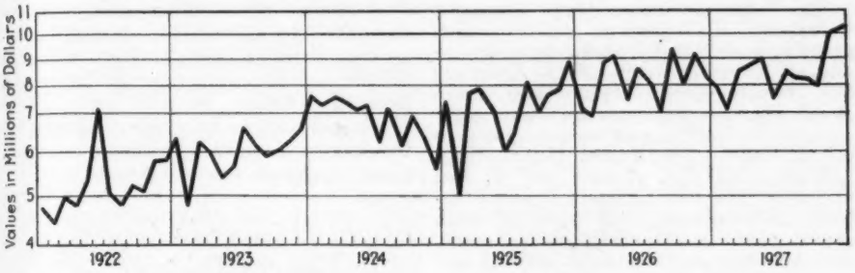
Item	1926 Commercial	1926 Municipal	1925 Commercial	1925 Municipal
Power plants	393	202	365	198
Stations buying power for distribution	98	362	91	353
Capital	$430,817,426	$325,402,640	$409,862,801	$316,858,286
Revenue*	47,911,555	41,022,178	42,195,540	37,146,041
Salaries and wages	8,596,178	11,346,822	7,827,114	10,928,793
Cost of fuel	916,350	1,221,032	1,023,593	1,242,643
Taxes	3,677,777	363,433	3,093,858	273,232
Employees, number	6,178	7,228	6,141	7,122
Customers, number	584,760	752,802	559,172	720,559
Energy generated, thousands of kw.-hr.	7,795,121	4,829,518	6,524,094	3,578,489
Prime movers, horsepower	2,423,244	1,346,079	2,243,318	1,326,209
Generators, kva.	1,938,048	1,057,339	1,803,545	1,041,164
Pole-line miles	14,257	15,438	13,047	14,606

*Gross revenue with duplications eliminated.

Business News and Market Conditions

Exports in 1927 Increase About 4 per Cent

Substantial increases are shown in the United States electrical equipment export trade in 1927. The value of exports in 1927 amounted to $102,340,129, which was the best since the record year of 1921. In 1926 electrical exports totaled $98,495,245. This increase is accounted for to a great extent by enlarged foreign markets for batteries, generators, fractional-horsepower motors, motor-driven household devices and washing machines. Exports of electric fans showed a small gain, while those for domestic heating and cooking devices declined.



Exports of electrical machinery, equipment and supplies from the United States
(Data supplied by the Bureau of Foreign and Domestic Commerce)

Exports to the Western Hemisphere amounted to $56,418,800, an increase of $2,994,800 over the preceding year. Canada is the largest consumer of our products and exports to that country showed an upward trend during 1927, the leading items being radio equipment. The next largest market in the Western Hemisphere was Argentina, whose imports of United States electrical equipment for 1927 amounted to $7,061,000, an increase of $1,857,400 over the preceding year.

Exports to European countries in 1927 amounted to $18,344,000, an increase of $3,960,200. Exports to Germany were valued at $1,391,800, an increase of $715,000. Shipments to Asia, Africa and Oceania showed a decrease of $3,140,000, part of which is accounted for by the large decrease of Japanese exports, which declined almost 50 per cent, or $4,239,000. Although exports to Australia, New Zealand and British India have decreased, these decreases are offset to a certain extent by an increase of trade with the Philippine Islands.

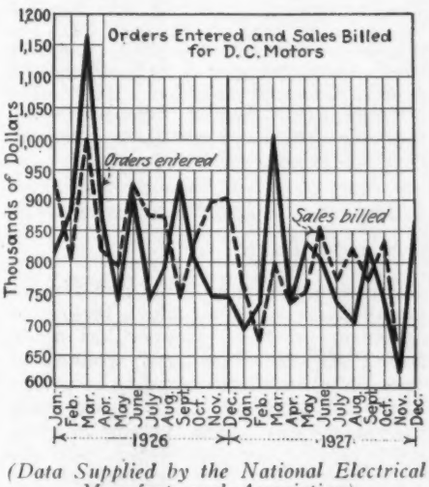
Liege Exposition in 1930

Plans are well advanced in Belgium for the "International Exposition of Industry, Sciences, Applications and Ancient Walloon Art" to be held at Liége in 1930 in celebration of the centenary of Belgian independence. "Electricity" forms the thirteenth group under the classification of "grande industrie" and is subdivided in the following manner:

(a) Production and storage of electrical energy; (b) transmission of current; (c) transformation of current; (d) applications of electricity to (1) mechanics, (2) metallurgy, (3) chemistry, (4) transportation, (5) lighting, (6) domestic purposes, (7) telephony, telegraphy and television, and (8) the medical art; (e) methods of control and measurement.

Each of the divisions mentioned will be in turn subdivided and the entire field of electricity will thus be covered. The director of the exposition is Nello Breteuil, and its Liége offices are at 4 Place Saint-Lambert.

Orders Entered and Sales Billed for D.C. Motors



(Data Supplied by the National Electrical Manufacturers' Association)

Electric Industrial Trucks and Tractors

March shipments of electric industrial trucks and tractors, as reported to the Department of Commerce by the nine leading manufacturers in the industry, were 131, compared with 119 in February and 116 in March, 1927. The accompanying table gives the shipments for 1926 and 1927, month by month, as well as shipments for the first three months in 1928.

SHIPMENTS OF ELECTRIC INDUSTRIAL TRUCKS AND TRACTORS

	Domestic			
1926	Tractors	All Other Types	Exports	Total
January	21	86	4	111
February	15	96	5	116
March	11	128	8	147
April	17	90	4	111
May	12	87	9	108
June	21	104	19	144
July	15	95	1	111
August	14	81	2	97
September	10	82	5	97
October	18	97	17	132
November	18	86	19	123
December	18	95	5	118
Total (year)	190	1,127	98	1,415
1927				
January	6	67	17	90
February	11	120	7	138
March	10	96	10	116
April	12	89	4	105
May	19	77	10	106
June	20	97	23	140
July	12	73	5	90
August	3	87	2	92
September	8	66	5	79
October	11	81	17	109
November	15	64	19	98
December	8	77	11	96
Total (year)	135	994	130	1,259
1928				
January	5	98	9	112
February	15	*86	18	*119
March	18	97	16	131

*Revised.

Orders for Electrical Goods

New orders booked during the first quarter of 1928, as reported to the Department of Commerce by 86 manufacturers of electrical goods, were $244,916,615, as compared with $239,999,298 for the last quarter of 1927 and $243,651,415 for the first quarter of 1927. The accompanying table gives the totals of bookings for each quarter since the beginning of 1923, not as a complete statement of the industry but as probably sufficiently representative to indicate the trend.

ORDERS FOR ELECTRICAL GOODS

Quarter	1923	1924	1925	1926	1927	1928
First	$225,399,383	$228,760,838	$233,023,182	$262,677,736	$243,651,415	$244,916,615
Second	240,542,824	221,167,876	227,502,652	248,000,075	236,427,121	.....
Third	201,910,099	185,747,314	232,933,532	241,114,209	*235,847,857	.....
Fourth	218,165,415	231,470,552	244,597,050	260,078,082	*239,999,298	.....
Total	$886,017,721	$867,146,580	$938,056,416	$1,011,870,102	$954,925,691	.....

* Revised.

Market Conditions

VOLUME of business as well as prospects look good in the New England district. Small motor sales showed a substantial gain. In the Eastern district a slight decline in orders is noted, but there is an encouraging volume of inquiries. A 60,000-kw. turbo-generator was purchased by an Indiana power company. Better conditions are noted in the Southeast. Order for $475,000 worth of generating equipment and $25,000 worth of oil circuit breakers were placed for a hydro-electric development in Alabama. An industrial plant in Georgia ordered $60,000 worth of rock crushing and mining equipment and an aluminum plant in Tennessee ordered three 6,000-hp. water wheels.

Equipment for a steel rod mill was purchased in the St. Louis district at a cost of $130,000. A good demand for building construction materials is reported. In the Middle West business is improving. An order was placed for $500,000 worth of paper insulated lead covered cable. Line extension and construction work is in good volume. On the Pacific Coast sales of pumping motors and small distribution transformers are good. Machinery and power apparatus orders were varied and in steady volume.

Better Conditions Noted in the Southeast

Conditions in the Southeast are better both in the central-station and industrial fields. Orders were placed for generating equipment approximating $475,000 and oil circuit breakers costing $25,000 for a hydro development in Alabama. Other good business is in more or less immediate prospect on general central-station apparatus, including some steam equipment. A large school in Tennessee ordered a turbine, stokers and condensers amounting to $45,000, while a small college in Georgia ordered lighting fixtures amounting to $3,500.

An industrial plant in Georgia has ordered $60,000 worth of rock crushing and mining equipment, $15,000 of this being for motors, while an aluminum plant in Tennessee ordered three 6,000-hp. water wheels. A steel mill in Alabama placed an order for four mine locomotives costing about $30,000 and a cotton mill in South Carolina purchased stoker equipment totaling $7,500. Small individual orders predominate in the industrial field, but the total volume of business is satisfactory and the most activity to be noted is in Alabama and the Carolinas. Orders for electrical materials, amounting to about $8,000, for a silk mill in Tennessee will probably be placed shortly and electrical equipment contracts on a bleachery in the Carolinas are in early prospect. Construction has started on the first $2,500,000 unit of a $10,000,000 rayon plant in Georgia. Municipalities are purchasing in reasonably good volume. A small town ordering line construction materials amounting to $2,000, while an order for "white-way" equipment, totaling $5,000, will probably be placed at an early date by another town. Purchases by contractors are increasing. Construction projects are as follows:

The Southern States Power Company, Fernandina, Fla., plans an expansion program to cost $100,000, including a substation on Jefferson Street. A. S. Andersen, 519 Twenty-eighth Street, West Palm Beach, Fla., and associates are organizing a company to build a cold storage plant, to cost $225,000. The Echota Cotton Mills, Calhoun, Ga., plan a plant unit to cost $100,000. The Baker County Power Company, Newton, Ga., will build a steam power plant at Moultrie, Ga. Leland, Miss., will receive bids until May 22, for equipment for a municipal power plant. The Mississippi Steel & Iron Company, Jackson, Miss., plans a mill to cost $100,000. The Planters Cotton Oil Company, Yazoo City, Miss., has authorized complete electrification of its plant.

The Nestles Food Company, New York, N. Y., plans a milk plant at Newton, N. C., to cost $200,000. Standard Looms, Inc., Spartanburg, S. C., plans a plant, for manufacture of textile machinery, to cost $175,000. The Tri-State Compress Company, Huston, Miss., will build a cotton compressing plant at Memphis, Tenn., to cost $300,000. The Pet Milk Company, St. Louis, plans a milk condensing plant at Abingdon, Va., to cost $200,000. The Alabama Power Company, Birmingham, plans a transmission line for service at Center Star, Killen, Shoal Creek Bridge, Ala., and vicinity. The Southeast Georgia Power Company, Alma, Ga., has acquired the municipal plant at Broxton, Ga. The Mississippi Power Company, Gulfport, Miss., has acquired the Richton Light & Power Company, Richton, Miss. The Virginia Public Service Company, Charlottesville, Va., has acquired the Stonewall Power Company, Manassas, Va.

Copper in Good Demand—Prices Firm

The general tone of the non-ferrous metal markets is firm and a feeling of optimism prevails. Copper has again had a normal week as to volume of sales, with little or no shading of prices. Zinc has advanced slightly and sold in considerably larger volume than in either of the last two weeks. On the other hand, lead and tin have been quieter than usual, with a little weaker price level for the latter metal. The monthly average prices for copper, zinc, and silver have shown a gain now for two successive months. This tendency upward, though very gradual, shows no sign of abating at the beginning of May.

NEW YORK METAL MARKET PRICES

	Apr. 25, 1928 Cents per Pound	May. 2, 1928 Cents per Pound
Copper, electrolytic	14.00	14.025
Lead, Am. S. & R. price	6.10	6.10
Antimony	10.00	10.375
Nickel, ingot	35.00	35.00
Zinc spots	6.15	6.225
Tin, Straits	52⅛	51⅛
Aluminum, 99 per cent.	24.30	24.30

Base copper wire price May 2, 1928, 16 cents.

The copper market is virtually unchanged either in price or in volume of sales though there has been less tendency to offer the metal at concessions from the prices at which most of the producers have held for some weeks. Export sales are satisfactory and the price continues at 14½ cents. Sales of lead have been considerably below normal. No appreciable change is observed in the market although two sales of fair tonnage were reported below the prevailing levels of 6.10 cents, New York and 6 cents St. Louis. Several of the largest domestic producers oversold their supply of metal in April.

Slight Decline in Orders in Eastern District

An encouraging volume of inquiries is reported in the Eastern district, but there is a noticeable decline in actual orders for primary equipment. An Indiana power company has contracted for a 60,000-kw. turbo-generator for delivery around the close of the year. A copper mining company in the Southwest is in the market for a 12,500-kw. unit, and is expected to place an order at an early date. A central-station company in northern New York has given a contract for cable of the medium voltage type, totaling about $15,000, and there is other business of this character in sight. Transmission apparatus also is in demand by several central-station companies in Pennsylvania and the South.

An order for switching equipment has been placed by a New York company at a price of $35,000. Transformer business continues rather spotty. One maker reports current business of lessened demand, with the bulk of the call for equipment of smaller capacity ratings; another producer says that things are fair in this line and has just contracted with a northern New York power interest for $100,000 worth. Electric railway business continues to lag. The Navy Department has ordered a turbine-gear drive for installation on a transport.

Industrial business is centered on motors at the present time and while orders are being received in reduced volume on individual account, fair gross sales are being recorded. Fractional units are in better demand than for several weeks past; one maker has secured a contract from a manufacturer of electrical apparatus for 1,000 1-hp. motors, totaling around $20,000. Control equipment sales are trending upward. Electric clock business is a feature of current activities and the improvement is expected to continue. A maker of time-pieces of this kind

has placed an order for 15,000 induction motors, with an Eastern manufacturer, to cost about $50,000. Immediate construction operations in the Eastern district include the following:

The Purty Boat Works, Port Washington, L. I., will make additions to cost $125,000. The Agfa-Ansco Corporation, Binghamton, N. Y., will build a camera-manufacturing plant to cost $2,000,000. The Public Service Electric & Gas Company, Newark, N. J., plans a substation at Jersey City, to cost $75,000, and another at South Orange to cost $70,000. The New Jersey Port Commission, Camden, N. J., plans a marine terminal to cost $2,000,000. The Heimbach Baking Co., Allentown, Pa., will build an addition to cost $200,000. The American Rolling Mill Company, Middletown, Ohio, will build an extension to its Columbia mill at Butler, Pa., to cost $1,000,000.

The Board of Education, Pittsburgh, Pa., will receive bids until May 15, for equipment for a proposed trade school. The Celanese Corporation, Amcelle, Md., will add to its rayon mill at a cost of $1,500,000. The Procter & Gamble Company, Cincinnati, Ohio, will build a soap-manufacturing plant at Baltimore, Md., to cost $3,000,000. The Quartermaster Depot, Camp Holabird, Md., will receive bids until May 9, for 115 storage batteries. The Quartermaster General, Washington, D. C., is asking bids until May 18, for three 750-hp. Diesel engines for Fort Mills, P. I.

Pumping Motor Sales Active on Pacific Coast

Machinery and power apparatus orders on the Pacific Coast include a 75-kva. generator, valued at $2,500, for a gas engine manufacturer; a 100-kva. gas engine generator, valued at $4,000, for a state polytechnic school; five large substation circuit breakers amounting to $17,500 for the Contra-costa substation of the Great Western Power Company; two 700-hp. synchronous motors and exciter set, valued at $12,500, for a Utah copper company; a five-ton storage battery locomotive and charging set, valued at $7,000, for a Sierra gold mine, and four refrigerator type motors amounting to $9,000 for food packing plants in San Jose and Monterey.

Manufacturers report excellent sales of pumping motors and small distribution transformers. Power company inquiries cover fiber conduit, and pin type insulators for the Bay section. Two carloads of assorted poles were ordered for Sacramento, and one carload of 7,500-volt line switches for Los Angeles. An unusual inquiry for San Jose delivery covers $1,000 worth of large rubber covered cable. Street lighting business includes $48,300 worth for Santa Barbara and a number of good prospects.

The city of Seattle will shortly buy machinery for a 25,000-kw. expansion of its Gorge Creek hydro-electric plant at a cost of about $500,000. Buhl, Idaho, plans an 800-hp. municipal plant to cost $150,000. The Washington Water Power Company plans a 110,000-volt line from Chelan to Wenatchee. Motor sales were light, the majority being small units for irrigation use and orchards. Construction projects are as follows:

The Los Angeles Gas & Electric Corporation, Los Angeles, plans an automatic substation on South Woodland Avenue, and another on Lawrence Street, to cost $75,000. The Southern Pacific Railroad Company plans shop extensions at Sacramento, Calif., to cost $2,000,000. The Oregon Short Line Railroad will add to its steam power plant at Pocatello, Idaho, to cost $100,000. Lima, Mont., has authorized a municipal power plant. The Northwestern Pulp & Paper Company, Astoria, Ore., will build a mill to cost $2,000,000. Modesto, Long Beach, and Los Angeles, Calif., plan ornamental lighting systems.

Small Orders in Good Volume Mark New England Trend

While heavy equipment sales have fallen off in New England and industrial activity has lessened in a number of branches, the volume of material moving and the prospects ahead are favorable. Small motor sales showed a substantial gain, and a large amount of new construction material was ordered. Industry, through reorganization of plants, is an active factor in buying. Service expansion has provided a good demand for transformers, meter sales are strong, small orders for switch and control equipment are noted, and specialties are quite active, among which may be included power tools, the sales of which are now very steady. Welding equipment and electric furnaces also are in demand.

Interior electric wiring projects are in advance over those of last year. Manufacturers of loom and paper mill machinery are busy and planning for Southern installations. Artificial ice making is receiving much attention. Among the installations planned should be added one for the Chelsea district as announced by the Boston Ice Company. The bill providing for additional water supply for Springfield, Mass., which includes plans for a 20,000 hp. development on Cobble Mountain has been signed. The Marborough Chamber of Commerce announces plans for the establishment of three new shoe industries in that city.

Business Improving in Middle West

Business in the Middle West is improving. The consensus of opinion is that April sales were favorable and the outlook is promising. Considerable new building construction is under way, particularly in the suburban districts, and general employment conditions are improving. Industrial activity is somewhat spotty. Contemplated expenditures of the various railroads are large and should tend to increase the volume of business. A very large amount of line extension and construction work is being done by the various utility companies, one of the most interesting being the construction of a hydro-electric plant on the Rock River at Rocton by the Wisconsin Light & Power Company, at a cost of $250,000. Among the orders placed were one for paper insulated lead covered cable valued at more than $500,000, disconnecting switches valued at $24,000 and several construction orders totaling $60,000. Construction projects are as follows:

The Chicago, Burlington & Quincy Railroad Company, Chicago, plans a power plant to cost $80,000. The Frank Foundry Company, Moline, Ill., plans an addition to cost $200,000. The Rockford Paper Box Company, Rockford, Ill., will build an addition to cost $125,000. The Showers Brothers Manufacturing Company, Bloomington, Ind., plans an addition to its kitchen cabinet plant, to cost $100,000. The Northern Indiana Public Service Company, Hammond, Ind., plans a steam power plant at Michigan City, Ind., to cost $5,000,000. The Grand Trunk Railway System will build an engine house at Ferndale, Mich., to cost $150,000. The Macklin Company, Jackson, Mich., plans extensions in its grinding wheel plant, to cost $100,000.

The Great Northern Railway Company plans shops at Grand Forks, N. D., to cost $125,000. The Cleveland Electric Illuminating Company, Cleveland, is negotiating for the purchase of the municipal plant at Ashtabula, Ohio. The Edward J. Shannon Company, Cincinnati, plans an addition to its paint manufacturing plant, to cost $75,000. The Andrew Jergens Company, Cincinnati, will add to its soap manufacturing plant, to cost $200,000. Thompson Products, Inc., Cleveland, plans additions to its plant to cost $250,000. The E. M. Hulse Furniture Company, Columbus, Ohio, plans a plant to cost $275,000. The Appleton Coated Paper Company, Appleton, Wis., will build an addition to cost $130,000. Elmwood Park, Ill., Ames, Keokuk and Boone, Iowa, and Lincoln, Neb., plan ornamental lighting systems.

Steel Rod Mill Places Order in St. Louis District

Manufacturers in the St. Louis district report the demand for stock sizes of apparatus has been considerably below normal but the belief is unanimous that the condition is only temporary. An order consisting of motors, transformers and control equipment for a steel rod mill was placed at a cost of $130,000. Another order was for a 100-hp. motor and other equipment amounting to $6,000. Jobbers report a good demand for building construction materials but no marked activity in line construction equipment. The general volume of jobbing business is considered satisfactory and the prospects look favorable. Construction projects are as follows:

The Peoples Utilities Company, Clinton, La., plans a power and ice plant at Clinton, La. The Quaker Oats Company, Chicago, will build a mill at St. Joseph, Mo., to cost $2,000,000. The General Tire & Rubber Company, Akron, Ohio, plans a factory branch at Kansas City, Mo., to cost $200,000. The Brown Cracker & Candy Company, San Antonio, Tex., plans a plant to cost $300,000. The Public Service Company of Oklahoma, Tulsa, Okla., will build a transmission line between Vinita and Jay, Okla. Bethany, Mo., plans an ornamental lighting system.

Activities of the Trade

Hubbard & Company Make Organization Changes

Two additions to the Pittsburgh plant of Hubbard & Company, manufacturer of pole line hardware and Peirce construction specialties, are now nearing completion. During May it is the intention of the company to move the Niles operation to Pittsburgh. The following organization changes also have been announced by C. L. Peirce, Jr., vice-president in charge of the electrical materials business of the company:

Joseph V. Smith, formerly Pacific Coast manager, is now Eastern manager in charge of the Pittsburgh plant and the territory served by it; W. R. Pounder continues as Central manager in charge of the Chicago plant and the territory it serves; Norris C. Husted, formerly manager of the Niles plant, has been made Pacific Coast manager in charge of the Emeryville, Cal., plant and the Pacific Coast territory; Wallace W. Glosser, formerly sales manager of the Verona tool works, has been made New York district sales manager with headquarters at 30 Church Street, New York City, and Thomas J. Farrell, formerly sales manager of the Universal Sales Company, has been made special representative in the New York district.

Copeland Products to Double Manufacturing Facilities

Construction of additional manufacturing facilities now under way by the Copeland Products, Inc., Detroit, will virtually double the production of the company's electric refrigerators. Property adjoining the present factory has been leased and it is expected that it will be ready for occupancy about June 1. "Rapid growth in demand for the Copeland product has made it necessary to enlarge our plant at an earlier date than we anticipated," said W. D. McElhinny, vice-president in charge of sales. "Our present plant has been credited by manufacturing experts with unusual efficiency and we had thought its capacity sufficient to take care of our requirements for several years yet. The Copeland business showed a 40 per cent increase in 1927, as compared with a 20 per cent average increase for the industry and in the first quarter of 1928 showed a further increase of 45 per cent over the same quarter of the previous year.

"It is not in anticipation of business that may develop, but to care for orders already on hand and immediately in sight that this plant expansion has been decided upon. However, in keeping with Copeland's policy of holding fixed assets at a minimum figure, additional facilities are being leased rather than purchased. Recent additions to the Copeland line have practically doubled its sales possibilities in the household, commercial and apartment house fields. We are also facing the necessity of caring for a big business on our new "Silica Gel" units, just in process of introduction, which will embrace everything in the field of commercial refrigeration."

THE LEONARD REFRIGERATOR COMPANY, Grand Rapids, Mich., announces that 3,782 Leonard refrigerators were shipped in a 43-car train in one day by the company over the Pennsylvania Railroad to dealers at various points through the United States, Canada and Mexico.

LANDERS, FRARY & CLARK, New Britain, Conn., manufacturers of electrical appliances, announce a new product, the "Univac" electric cleaner, selling for $34.50, with attachments $5 extra.

THE PENN ELECTRIC SWITCH COMPANY, Des Moines, Iowa, announces that it has taken over the Wilboken Manufacturing Company of Milwaukee, which will be continued for the present as a division of the Penn Electric Switch Company.

THE WRIGHT MANUFACTURING COMPANY, Lisbon, Ohio, manufacturer of chain hoists, trolleys and cranes, announces the sale of its business and trade name to the American Chain Company, Inc., Bridgeport, Conn. There is no anticipated change in policies or sales organization of the company. H. F. Wright and W. F. Wright will continue in charge of sales and production of Wright products.

THE NATIONAL LAMP WORKS OF THE GENERAL ELECTRIC COMPANY, Nela Park, Cleveland, is offering a stereopticon projection film on "Home Lighting" and a talk to accompany it. This illustrated talk is particularly useful to organizations which are interested in relighting-the-home activities. It portrays the principles of good home lighting and gives practical suggestions for properly lighting each room in the home. Copies of the film and talk are available at a cost of $5. It was prepared by M. Luckiesh of the lighting research laboratory of the company.

THE GENERAL ELECTRIC COMPANY has received an order for carrier-current communication equipment for use in conjunction with the Big Creek line No. 3 which will connect the Magunden and Gould substations of the Southern California Edison Company. The equipment will include ten coupling capacitors and the latest type of vacuum-tube carrier-current apparatus. The Southern California Edison Company previously had in operation a similar system on two of its 220,000-volt transmission lines.

THE DAMPNEY COMPANY OF AMERICA, Hyde Park, Boston, announces that the sale of its "Apexior" protective coatings for power plant equipment will be handled in southern Texas by the Maintenance Engineering Corporation, 2000 Harrington Street, Houston.

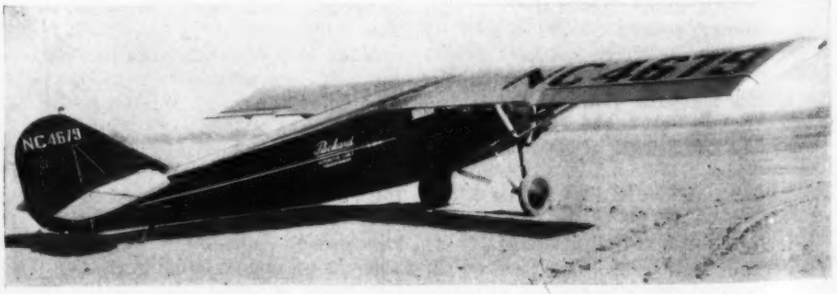
S. A. WEISS & COMPANY announces its removal to Room 510, 342 Madison Avenue, New York City. The company represents the Minerallac Electric Company of Chicago, Thoner & Martens of Boston, the J. L. Gleason Cable Reel Company of Boston and the Line Material Company of Milwaukee.

THE A. J. LINDEMAN & HOVERSON COMPANY, Milwaukee, manufacturer of electric cooking and heating appliances, announces that the new L & H electric ranges are now being made in color. Shades of Alice blue, Arabian tan, Nile green, Oriental yellow and coral red with a background of old ivory are available.

THE GENERAL ELECTRIC COMPANY is now issuing specifications in which the G.-E. wiring system is applied to apartment houses and apartment hotels. These specifications show the wiring layouts for typical apartments of the one-story and two-story type, also the wiring for the simplex, duplex and studio designs.

THE FOXBORO COMPANY, INC., Foxboro, Mass., manufacturer of indicating, recording and controlling instruments, announces a new push-button chart hub for use with its recording instruments. It accurately centers the chart and can be easily detached.

Packard Electric Uses Plane in Sales Work



This Stinson-Detroiter six-passenger cabin monoplane will be used in sales work by N. A. Wolcott, president; W. F. Parker, general manager of the transformer division, and engineers of the Packard Electric Company.

New Equipment Available

Air Filter

The "Simplex" air filter developed by the National Air Filter Company, Chicago, consists chiefly of a large cylindrical drum which is closed at one end and carries the filtering medium on the outside surface of the cylinder. A segment of the drum which can be rotated is always immersed in oil. The filtering medium comprises layers of expanded metal for pre-cleaning and mats of heavy twisted copper ribbons of specially woven fabric wound layer upon layer for the final stage.

Under average conditions the drum is turned one-fifth of its circumference once a week and this immersion period gives the oil ample time to clean the filters thoroughly by solvent action. The company states that the "Simplex" filter combines the features of its "Rotary" and "Phoenix" air filters, but does not displace either of them. Standard sizes range from 800 to 40,000 cu.ft. per minute, and by using additional units any capacity can be secured.

Portable Oscillograph

An improved type of portable cathode ray oscillograph for use in making laboratory and field measurements of transient electric phenomena has been announced by the General Electric Company. The unit is entirely self-contained and requires only a source of 110-volt alternating current to operate it. The company states that although extremely accurate measurements are possible with the new instrument it is ruggedly constructed and can be handled successfully with only the ordinary care required by other portable laboratory equipment. The instrument consists of two units, each mounted on a separate truck. The first unit contains the photographic recording apparatus and high-vacuum pump, while the second includes the rough vacuum pump, synchronous switching mechanism and cooling water system. The two units together weigh about 700 lb. and each occupies about the same amount of space as an office desk.

The oscillograph is of the high-voltage cold cathode type, operating on 30,000 to 60,000 volts, supplied by a transformer. The tube is built into the end of a metal bell which contains the film holder and the whole interior is exhausted of air during operation. When excited the cathode of the tube emits a stream of electrons which traverse the length of the vacuum chamber and impinge upon the film. The stream is acted upon by a number of electromagnetic and electrostatic fields imposed on it by means of several sets of electromagnets and parallel plates, so that both voltage and current waves may be recorded. When transients of very short duration are to be photographed the beam is given an undulatory path across the film by the action of an electrostatic field supplied by a high-frequency oscillator included in the unit. This greatly increases the length of the ray path and also furnishes a timing wave by which to measure the duration of the transient. The frequency of this timing wave may be adjusted for any value between 20,000 and 1,000,000 cycles per second and its voltage may be given any value from 10 to 1,000 volts, depending on the wave amplitude desired.

The oscillograph finds its greatest use in recording transient electric phenomena with wave fronts equivalent to frequencies from 10,000 to 1,000,000 cycles per second, although frequencies of 100,000,000 cycles have been recorded. Some of the classes of work for which the instrument is especially fitted are: Volt-ampere studies of lightning arresters; recording of transient phenomena during switching on power lines; volt-ampere studies of mercury-arc rectifier characteristics; measurement of power amplifier characteristics, and measurements of pressures and time intervals along a gun barrel with the movement of a bullet.

Switchboard Wire

An asbestos and varnished cambric insulated switchboard wire, with a smooth outer cotton braid which can be furnished in either gray or black, has been placed on the market by the Rockbestos Products Corporation, New Haven, Conn. This switchboard wire is especially adapted for wiring switchboards in power plants and substations. The wire consists of a tinned copper conductor insulated with two layers of varnished cambric, 30 units of felted asbestos saturated with a flameproof and moisture-resisting compound and an outer covering of gray or black flameproof cotton braid. It is said that the braid, which is closely woven, will not break or open on sharp right-angle bends.

INSULATOR.—A line of 6,600-volt and 8,800-volt insulators in color has been placed on the market by the Corning Glass Works, 369 Lexington Avenue, New York. The insulators are known as the marker type and are intended for the purpose of identifying low-voltage distribution lines.

BINDING-WIRE TENSION INDICATOR.—A device for use in the repair of railway and industrial haulage motor armatures has been developed by the General Electric Company. This device indicates the exact strain or tension in pounds that is applied to the steel binding wire by the binding machine or lathe and provides a simple means of keeping track of this tension throughout the full operation of binding up the armature. By its use the binding wire will not be stressed beyond the elastic limit or tensile strength of the steel and will be kept under uniform tension during the process of winding it in place.

Starters for D.C. Motors

A complete new line of direct-current motor starters for general purpose applications has been introduced by the General Electric Company. These starters are designed to provide definite time acceleration for constant- and adjustable-speed motors and are divided into five types, bearing the designations CR-4065, CR-4066, CR-4166, CR-4068 and CR-4168. One of the principal advantages of the new design is the fact that, despite a reduction in size, the number of accelerating points has been increased. An improved appearance is secured by the use of drawn-shell inclosing cases.

The CR-4065 starter is a constant-speed type for general purpose applications and the CR-4066 is the same type with the addition of dynamic braking. The CR-4166 is an adjustable-speed type with dynamic braking and full-field features. The CR-4068 is a constant-speed type, reversing, with dynamic braking. The CR-4168 is an adjustable-speed type, reversing, with dynamic braking and full-field features.

On those starters provided with dynamic braking a small relay is used to prevent the solenoid from being re-energized until the motor has come to rest. The contacts of this relay are connected in the pick-up circuit. Thermal overload protection is provided by means of single-coil relays designed for overload protection and having a thermal capacity to stand high inrush currents. These relays operate only in extreme conditions and serve as a warning to the operator that the motor or wiring requires attention.

Disconnecting Switches

A line of high-tension reversible and interchangeable disconnecting switches has been placed on the market by the High Tension Company, 149 Broadway, New York City. All switch bases are of the channel type and all switches have double blade construction. Switches up to and including 22,000 volts have the U type blade; switches for 33,000 volts and above have the truss type.

The salient features pointed out by the manufacturer are: Reversible standard parts for inverted, upright or vertical mounting; interchangeable insulator units with cemented or adjustable non-cemented caps and pins; mounting holes symmetrical; offset pulling ring accessible at any angle; positive locking device; full-floating, self-aligning adjustable double pressure contacts; double switch blades; U-bolt type of clamp terminals; switch blade stops at 90 deg. or 135 deg., and the elimination of tapped holes.

Electrical Patents

Announced by U. S. Patent Office

(Issued April 17, 1928)

16,935 (reissue). ELECTRICAL STEAM GENERATION; T. H. Noll, Bronx, N. Y. App. filed Aug. 31, 1923.

1,666,065. MAGNETIC MOTOR; O. R. Anderson, Pasadena, Calif. App. filed April 1, 1924.

1,666,089. CONNECTER FOR ELECTRIC CIRCUITS; H. C. Foster, Connersville, Ind. App. filed July 25, 1927. Multiple circuit socket adapted to insure contact for three or more pairs of terminals.

1,666,129. TIME SWITCH; W. A. Frantz, Cleveland, Ohio. App. filed Jan. 21, 1924.

1,666,223. ELECTRIC-FIXTURE SUPPORT; W. Symmes, San Francisco, Calif. App. filed Oct. 23, 1922.

1,666,247. ELECTRIC CORD SWIVEL CONNECTER; C. Schuldt, Des Plaines, Ill. App. filed March 27, 1925.

1,666,248. THREE-WAY LAMP SOCKET; C. Schuldt, Des Plaines, Ill. App. filed July 22, 1925.

1,666,281. MAIL BOX; A. E. Delbert, Seattle, Wash. App. filed June 4, 1927. With an electric signal, as a bell.

1,666,282. PRESSURE-FLUCTUATING ALARM FOR MINES; R. C. Fagan, Spangler, Pa. App. filed Oct. 29, 1924.

1,666,309. MAGNOMETER; J. N. Ray, Newark, N. J. App. filed Nov. 26, 1924. Apparatus for testing the magnetism of electromagnetic sound reproducing devices.

1,666,320. LOCK-CONTROLLED ELECTRIC SWITCH; F. J. Watts, Bronson, Mich. App. filed Aug. 3, 1927.

1,666,338. ELECTRIC SWITCH; G. J. Meuer, Milwaukee, Wis. App. filed Jan. 18, 1926. Toggle type.

1,666,339. LUMINESCENT FUSE PLUG; L. F. Miller, Minneapolis, Min. App. filed Oct. 22, 1926.

1,666,351. ELECTRIC STRIKING MECHANISM; S. Rollin, Tulle, France. App. filed March 8, 1927.

1,666,411. ELECTRIC CONNECTER SOCKET; H. D'Olier, Jr., Bridgeport, Conn. App. filed Dec. 14, 1925.

1,666,433. SYSTEM OF ELECTRIC DISTRIBUTION; B. S. Weinfield, Schenectady, N. Y. App. filed June 28, 1926. For automatically controlling the connections and operation of a source of current whereby it is connected to a load circuit only under certain predetermined conditions, and whereby its output is limited to a safe value under abnormal load conditions.

1,666,435. SYSTEM OF ELECTRIC DISTRIBUTION; H. Bany, Scotia, N. Y. App. filed Jan. 8, 1926. An arrangement for controlling the operation of the interconnecting dynamo-electric units upon the occurrence of a reversal of energy flow.

1,666,452. GENERATOR FOR ELECTRIC-ARC WELDING; M. M. Irvine, Glasgow, Scotland. App. filed Feb. 15, 1927.

1,666,457. BRUSH LIFTER FOR ELECTRIC MOTORS OR THE LIKE; G. H. Leland, Dayton, Ohio. App. filed March 22, 1926.

1,666,459. BRUSH-LIFTING MECHANISM FOR ELECTRIC MOTORS OR THE LIKE; G. H. Leland, Dayton, Ohio. App. filed July 13, 1927.

1,666,470. ELECTRIC SWITCH; D. A. Sanford, Deceased, late of Washington, D. C. App. filed March 27, 1924. For attachment to the under surface of the floor of an elevator car and to be operated by the foot to energize an electro-magnet.

1,666,471. SYSTEM OF ELECTRIC DISTRIBUTION; H. T. Seeley, Schenectady, N. Y. App. filed Feb. 17, 1926. Comprising a supply circuit and a load circuit interconnected for controlling the operation of the inter-connecting units upon the occurrence of a reversal of energy flow.

1,666,473. HIGH-VOLTAGE DIRECT-CURRENT SYSTEM; J. Slepian, Swissvale, Pa. App. filed Feb. 26, 1921.

1,666,498. FLOAT-OPERATED ELECTRIC-SWITCH-ACTUATING MECHANISM; C. W. Lindemann, Chicago, Ill. App. filed April 9, 1926.

1,666,546. ELECTRIC LIGHTER FOR CIGARS, CIGARETTES, ETC.; S. L. Wolfson, Meriden, Conn. App. filed Feb. 18, 1928.

1,666,588. ELECTRIC MOTOR; M. Andis, Racine, Wis. App. filed June 26, 1926. Intended to develop light power under circumstances where considerations of size and weight are important.

1,666,589. ELEVATOR SIGNAL SYSTEM; C. W. Bassett, Montclair, N. J. App. filed April 17, 1926.

1,666,639. HOSPITAL SIGNAL SWITCH; J. O. Cadieux, Meriden, Conn. App. filed May 6, 1925.

1,666,675. CIRCUIT MAKING AND BREAKING DEVICE; T. Zweigsberck, London, England. App. filed Dec. 20, 1923. An electro-magnetically operated circuit breaker having an independently, mechanically operated mechanism adaptable for conjoint action with the electro-magnetic mechanism to close the circuit.

1,666,680. DYNAMOMETER; O. E. Buckley, Maplewood, N. J. App. filed Dec. 30, 1922.

1,666,697. DIATHERMIC APPARATUS; G. Grossmann, Berlin, Germany App. filed Oct. 7, 1927.

1,666,724. INCLOSED ELECTRIC SWITCH; D. T. Wadsworth, Cold Springs, Ky. App. filed Aug. 15, 1924. Meter service switch.

1,666,729. ELECTRIC FIXTURE; W. G. Biek and G. D. Rice, Dowagiac, Mich. App. filed July 20, 1927. Attachment plug adapted to be used in floors covered with rugs, the connection being made through the rug.

1,666,762. SEPARATOR FOR THE ELECTRODES OF ELECTROLYTIC CELLS; J. L. Woodbridge, Philadelphia, Pa. App. filed July 12, 1927.

1,666,763. SWITCH; G. A. Yanochowski, La Grange, Ill. App. filed May 31, 1924. Horn button.

1,666,816. AIR CIRCULATING AND HEATING APPARATUS; P. R. Falk, New York, N. Y. App. filed Nov. 22, 1926.

1,666,831. ELECTRIC HEATER; C. Pandolfo, Montevideo, Uruguay. App. filed Nov. 3, 1926.

1,666,876. LAMP FOR USE ON MOTOR VEHICLES AND FOR OTHER PURPOSES; S. L. Price, London, England. App. filed Jan. 17, 1923.

Information on foreign patents can be obtained through the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

New Trade Literature

FURNACE TYPE TERMINAL MOUNTINGS.—The Globar Corporation, Niagara Falls, N. Y., is distributing bulletin D, giving details of standard furnace type "Globar" terminal mountings. A drawing shows a typical cross-section through a furnace equipped with "Globar" electric heating elements, and detail drawings show the "Globar" terminal and mounting assembly, self-cooled and water-cooled. The bulletin also contains instructions for replacing "Globar" electric heating elements while the furnace is in operation.

LIGHTING UNITS AND FLOODLIGHTS.—Bulletin GEA-359A issued by the General Electric Company, Schenectady, N. Y., describes and illustrates the "Novalux" ornamental lighting units for street lighting. The company also is distributing bulletin GEA-161B covering searchlight and airport lighting, including floodlighting projectors, incandescent searchlights and aviation beacons. The bulletin covers the application of floodlighting to buildings.

FEEDER EQUIPMENT FOR MINING SERVICE.—Leaflet No. L. 20,115-A, issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., covers its automatic direct-current feeder equipment for mining service.

GROUNDS.—"Grounding Facts" is the title of a booklet issued by the Paragon Electric Company, 37 West Van Buren Street, Chicago. While the booklet gives information on Paragon grounds, directions for their installation etc., it is virtually a treatise on the general subject of grounding and contains information concerning the grounding of transformer secondaries, transformer neutrals, protection of station equipment, feeder circuits, arc-lighting circuits, trolley circuits, railway signal installations, etc.

LIGHTNING ARRESTERS.—A booklet issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, entitled "The Preferred Lightning Arrester of Today—Why?" is the seventh of a series describing the technical features of the crystal valve lightning arresters as they apply to modern lightning protection.

STARTERS.—The Monitor Controller Company, Baltimore, is distributing bulletin No. 112, covering the Monitor "Thermaload" starter designed for any type of drive where single-phase or polyphase motors are connected across the line. It contains a table of ratings, dimensions and weights of the Monitor starters and a table of the ampere rating of the thermal units to be used with induction motors.

TRANSMISSION MACHINERY.—Catalog No. 22 issued by Winfield H. Smith, Inc., Springville, N. Y., describes and illustrates its line of speed reducers, hangers, pillow blocks and other light power transmission machinery.

MOTORS.—The General Electric Company, Schenectady, N. Y., has issued a bulletin describing its standardized type MD-400 mill motors. Illustrations are given showing a few standard arrangements and some of their many applications.

INSULATING MACHINES.—Bulletin No. 332 issued by John Royle & Sons, Paterson, N. J., describes and illustrates its perfected insulating machines patented for applying die-formed rubber or plastic coatings upon electric conductors and other materials. The bulletin covers the features of construction and contains specifications covering the various machines.

MOTORS. — Bulletins GEA-752 and GEA-894 issued by the General Electric Company, Schenectady, N. Y., describe and illustrate its type BD constant and adjustable-speed direct-current motors and type CD adjustable-speed direct-current motors.

COMPRESSORS AND VACUUM PUMPS. —The Ingersoll-Rand Company, 11 Broadway, New York City, is distributing bulletin No. 3150, in which it describes and illustrates the class ER and FR compressors and vacuum pumps suitable for machine shop, factory, foundry, mine, quarry and power plants, also for air-lift pumping, liquid agitation and gas distribution. Various photographs show the detailed construction of the machines.

CONTROL EQUIPMENT AND BRUSH-HOLDERS. — The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-308A, describing and illustrating its arc suppressor plates for drum controllers. The company also is distributing the following bulletins GEA-934, covering the CR7896 automatic throw-over panels; GEA-835A, covering the CR4066, CR4068, CR4166 and CR4168 direct-current magnetic controllers for constant and adjustable-speed motors; GEA-948, describing the CR4065 direct-current magnetic controllers for constant-speed motors; GEA-950, covering the CR1028 alternating-current inclosed starting rheostats used in conjunction with primary switches for slip-ring induction motors, and GEA-760A and GEA-838A, covering its improved brush-holders and ventilated covers for GE-275 and GE-247 railway motors, respectively.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Melbourne, Australia (No. 30,912), of battery chargers.

Purchase is desired in Sheffield, England (No. 30,913), of battery-charging panels.

Purchase and agency are desired in Otanes, Spain (No. 30,895), for electric galvanizing apparatus.

An agency is desired in Munich, Germany (No. 30,908), for household electrical appliances, especially washing and ironing machines.

Purchase or agency is desired in Montreal, Canada (No. 30,909), for electric lamps, standards and shades and another (No. 30,935) for electric surfacing machines.

Purchase and agency are desired in Melbourne, Australia (No. 30,910), for electric hand vacuum brushes for automobile upholstery.

An agency is desired in Frankfort, Germany (No. 30,876), for electric washing machines.

Purchase is desired in Temuco, Chile (No. 30,931), of wiring supplies and fixtures.

Any manufacturer desiring to establish agencies abroad may consult with the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce, where data on available agencies throughout the world are on file.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

South's Rapid Increase in Industrial Activity

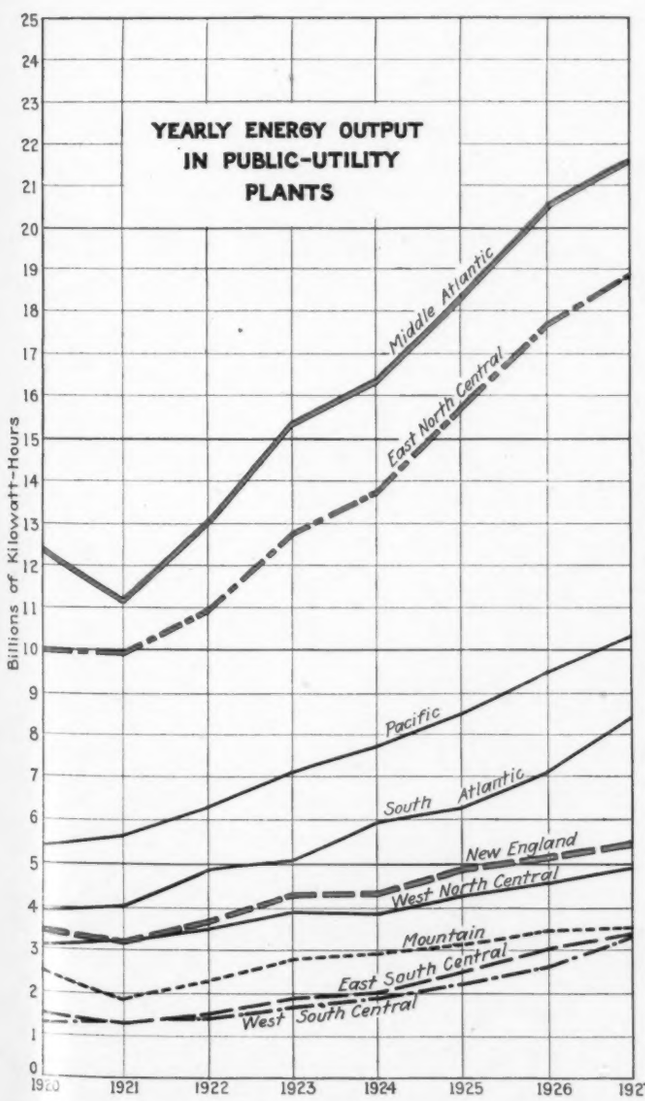
ELECTRICAL energy production is generally acknowledged to be a reliable indicator of industrial activity. Broadly speaking, those countries or regions which range high in this regard are conspicuous industrial regions; those in which the growth in energy output is relatively rapid are likely to be advancing at a corresponding rate industrially.

The accompanying curves of regional energy production in public utility plants of all kinds were plotted from statistics published by the United States Geological Survey. One is drawn to the ordinary uniform scale. It shows the three regions constituting the industrial belt along the northeastern portion of the country as comprising the great power-using section.

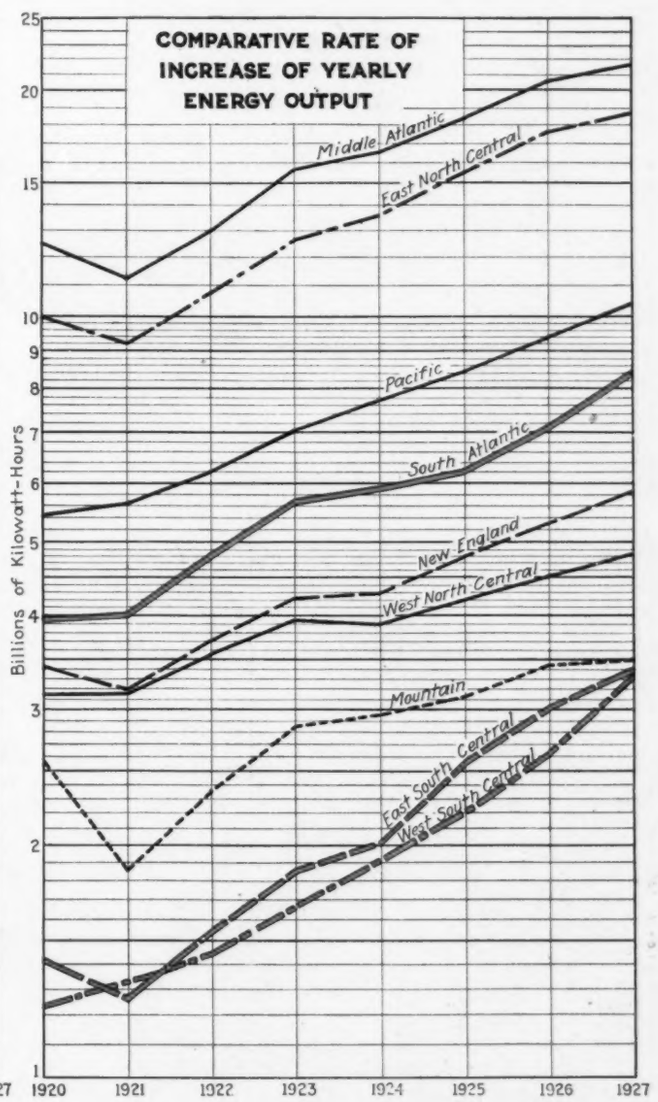
But the three Pacific States, with a smaller population than New England and about a quarter as populous as the Atlantic States, far exceeded these two regions in their relative use of electricity.

On the other chart the same figures are plotted, but to a scale that shows equal percentage growth by an equal slope of the curves, regardless of the actual amounts. The steepest slope indicates the fastest rate of increase.

A predominant position with respect to rate of growth is at once evident in the two South Central regions. The other Southern section, the South Atlantic, although much higher in absolute output, has had a slower rate of increase, but taken as a whole the South has been gaining in electrical output more rapidly than the rest of the country, with the Pacific States next in order.



The industrial Northeast has the largest output



The "new South" has the most rapid growth

New England Production 2.7 per Cent Down During First Quarter

THE rate of general production in the New England States during the first quarter of 1928 was on an average about 2.7 per cent under that reported for the same period during 1927, as indicated by the consumption of electrical energy by some 400 large manufacturing plants scattered throughout the section. As has been the case during the last five years, the peak of operations in New England manufacturing plants as a whole this year was reached in February, the March rate of production, after correction is made for the number of working days, being about 6.2 per cent under February. The March activity was also 2.6 per cent under March, 1926.

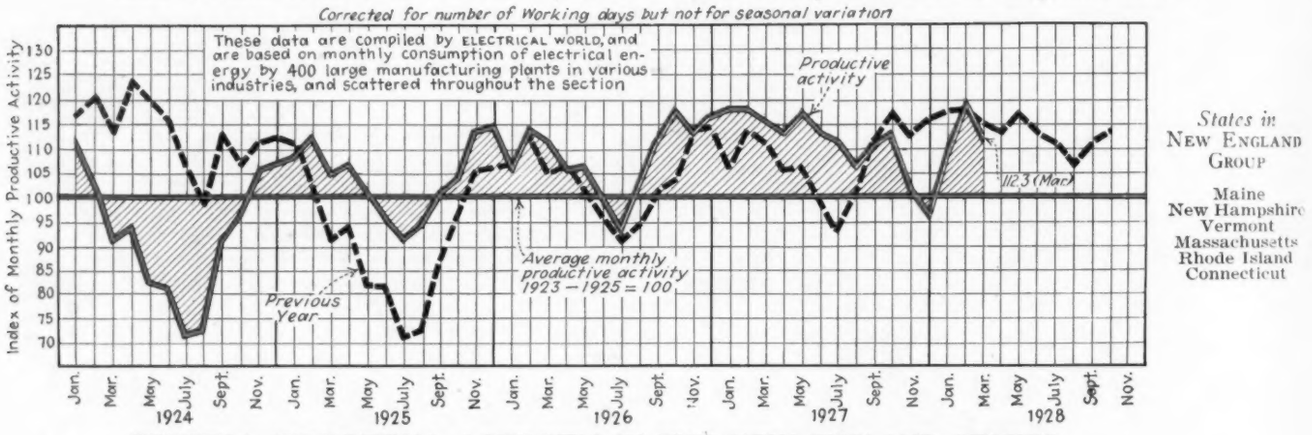
The favorable position of New England industry as a whole, however, is evidenced by the fact that all of the primary industries with the exception of textiles reported an average rate of production during the first quarter materially above that reported for the same period last year. Textile plants as a whole have been reporting a lower rate of production than the year previous ever since last September, the low point being reached in December, when the rate of operations was 22 per cent under December, 1926. The high weight given to the index of textiles activity serves to bring the index of general activity below that of the year previous.

Indexes of Productive Activity in the New England States

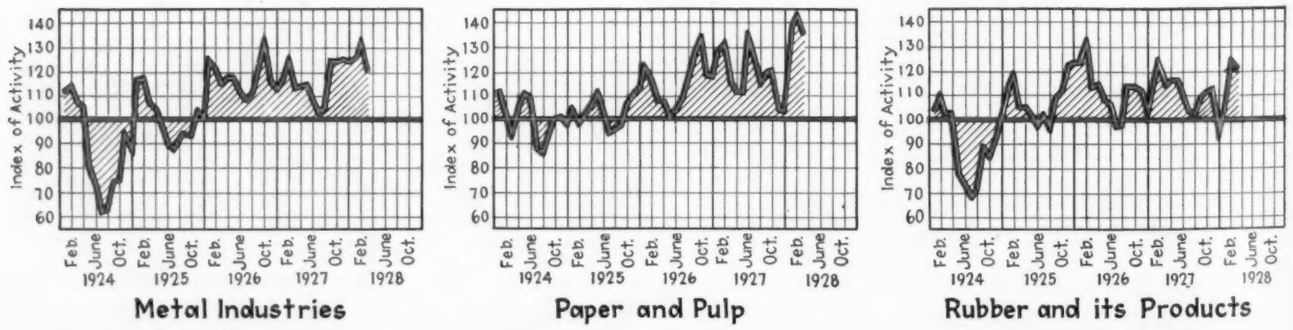
All Figures Adjusted for Number of Working Days

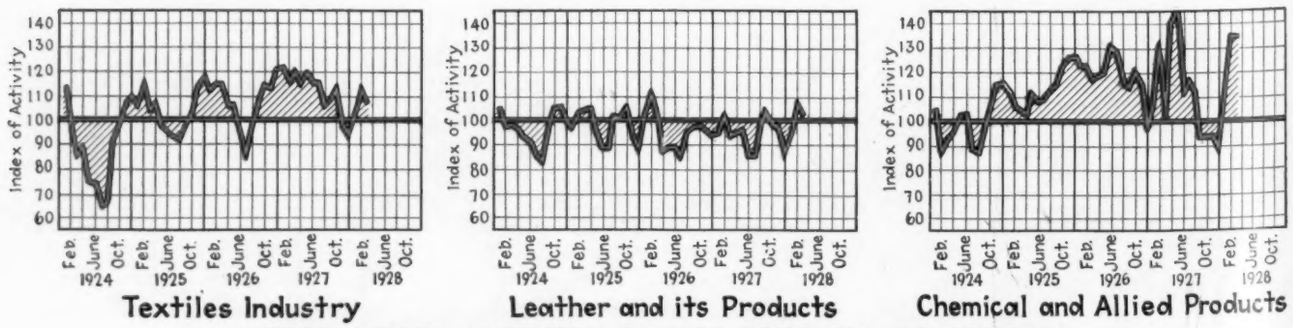
	March, 1928	Feb., 1928	March, 1927	Average for First Quarter, 1928	Average for First Quarter, 1927
All industry	112.3	119.7	115.2	113.7	116.8
Chemical and allied products	134.8	135.8	102.5	130.2	113.7
Leather and its products	100.6	108.4	93.5	101.7	96.1
Lumber and its products	110.7	115.4	.....	107.4	.....
Metal industries group	120.6	133.1	113.7	126.5	118.7
Paper and pulp	136.2	143.0	116.0	139.4	125.0
Rubber and its products	120.4	126.0	114.8	117.8	116.5
Textiles	107.3	114.2	120.0	108.5	119.5

ELECTRICAL WORLD *Barometer of Industrial Activity in the New England States*


Corrected for number of Working days but not for seasonal variation
These data are compiled by ELECTRICAL WORLD, and are based on monthly consumption of electrical energy by 400 large manufacturing plants in various industries, and scattered throughout the section
Index of Monthly Productive Activity
Productive activity
112.3 (Mar.)
Average monthly productive activity 1923 — 1925 = 100
Previous Year
Jan. Mar. May July Sept. Nov.
1924 1925 1926 1927 1928
States in NEW ENGLAND GROUP
Maine
New Hampshire
Vermont
Massachusetts
Rhode Island
Connecticut

GENERAL INDUSTRIAL ACTIVITY IN THE NEW ENGLAND STATES





PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE NEW ENGLAND STATES